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Prevention and Cure

TIME was when an interruption in the supply of electricity was not of serious consequence unless it happened during the lighting peak in winter, and distributors could be taken out of commission for a few hours during the day for maintenance or making connections without inconveniencing anybody.

Nowadays, however, so much depends upon the availability of electricity at all hours of the day and night—the running of factories, domestic cooking and heating, railways, hospitals, water-heating and other off-peak loads—that at no time is a cessation of supply permissible if it can possibly be prevented.

Coupled with a growing need for a higher standard of reliability is the much greater technical difficulty of obtaining it. This difficulty is due mainly to the more complex conditions involved in meeting electrical demands due to their very magnitude—heavier currents, higher voltages and far more severe short-circuits and in addition the vagaries of transient phenomena in many miles of interconnected overhead lines.

The important question is how far the technique of preventing interruptions of supply is keeping pace with modern requirements at a price that will not hamper electrical development as a whole. That is not the same thing as securing entire immunity from failure of apparatus; rather is it an application of the old principle that the function of protective gear is primarily to safeguard the system by the prompt disconnection of faulty components, thus enabling the supply to be maintained to the consumers.

The last is a sound enough generalisation, but the intricacy of the problem in practice is illustrated by the differences of opinion that exist regarding the advisability of bus-zone protection. The discussion here resolves itself into an inquiry as to the relative risks attached to leaving the controlling centre without protection and the possibility of tripping in circumstances that are not serious enough to justify it.

One of the main functions of protective relays is to prevent sustained arcing, which has been responsible for most major breakdowns recently. Much thought is being given to methods of mitigating the results of such occurrences in fire, explosion and prolonged interruptions of supply, but this should not be permitted to obscure the prime importance of preventing an arc being maintained at the outset.

In their I.E.E. paper last week Messrs. H. W. Clothier, B. H. Leeson and H. Leyburn put this aspect in its correct perspective by laying most emphasis upon the removal of causes as distinct from effects. Prominent among the methods discussed for dealing with faults at their inception was high-speed switching, but an interesting line of speculation is how far means can be adopted (examples of which already exist) for ascertaining weak spots in advance.

Behind all, however, as the authors point out, is the fundamental requirement of using insulation of high quality and testing it stage by stage during manufacture. First-class design and workmanship still remain the primary considerations, but the operating engineer has a duty over and above that of maintaining his plant adequately. Only by his collaboration with the manufacturer in compiling careful data on its performance under practical conditions can the most suitable and reliable designs be evolved at the lowest cost.

Engineers and the Public

WE are prone to adopt undesirable American ideas in this country, but occasionally we copy useful ones. We presume that the idea of the "public relations officer" is of the latter kind. All the leading public bodies appear to be appointing such officials, and one of them, Lt.-Col. F. H. Budden, of the Institution of Civil Engineers, has now become public relations officer to the engineering profession as a whole. The principal aim of the Engineering Public Relations Committee is to give the man in the street a better understanding of the importance of the engineer in the life of the community. It proposes to do this by a number of methods—the Press, the

B.B.C., films, lectures, etc. The result should be to raise the engineer in the public's estimation to somewhat the same plane as that on which doctors and barristers are placed. Too many members of the public still visualise the engineer as a man in dungarees grasping a lump of oily waste or a spanner.

Manchester Trolley-Buses

THERE are many features of the trolley-bus system shortly to be inaugurated in Manchester that will repay investigation by transport managers. Not the least interesting of these are the modifications proposed in the crossings, frogs and section insulators, one of the advantages of which is that complete fittings can be made up by the emergency staff from spare parts that occupy little stores space. Tensile tests on the type of clamping adopted for securing the trolley wire in the section insulator have, we are informed, resulted in the wire breaking first, generally outside the end-piece. Advantages are also anticipated from another departure from ordinary practice in the type of shoe collector used. On the power supply side, the disposition of the sub-stations, together with automatic coupling between overhead sections, seems to yield the most favourable overall results in reconciling the varying requirements of small voltage drop, low cost of d.c. distribution and minimum of sub-station plant. Two questions that have been debated in the past have been settled for Manchester. Battery propulsion is provided to enable a trolley-bus to be driven into a side road in order to avoid traffic congestion in the event of a breakdown, and an all-insulated system is envisaged as a later possibility.

Plant Construction in Canada

EVIDENCE of a renewal of plant construction on a large scale is contained in a survey of hydro-electric progress in Canada in 1937, details of which appear on another page. With the mining demand expanding at the rate of 100,000 h.p. a year, new installations in 1936 aggregated no more than the equivalent of one large plant—36,000 h.p.—and reserve generating capacity dwindled. However, a start had been made on a number of important projects and last year saw a much larger addition to the available plant, the capacity at the end of the year being 8,113,000 h.p., an increase of 167,000 h.p. Moreover, the further appreciable improvement in consumption, both industrial and domestic, made it necessary for new schemes to be considered. One of the most far-reaching plans being studied is a diversion of the Nechako River, by means of which it is estimated that 1,500,000 h.p. could be made available. The sanctioning of more than 1,900 miles of new rural circuits by the Hydro-electric Commission of Ontario conveys an idea of the extent of development in that province.

Variety at the Institution

IN commenting upon the programme of the first half of the I.E.E. session we stressed the varied character of the papers and lectures. The programme for the second half, detailed on another page, sustains this feature. At next week's ordinary meeting two papers on domestic electric cookers are to be presented, dealing with design and maintenance, respectively. Commercial cooking received attention at an informal meeting on Monday last. Other subjects for the session include a moving-coil voltage regulator; ignition of explosive mixtures in operating theatres; the lighting load; power rectifiers; plastics and electrical insulation; electric locomotive design; television; and the statistical laws of Nature. The session concludes with the Kelvin Lecture by Dr. A. P. M. Fleming on "The Evolution of Electric Power." The Meter and Instrument Section is to direct its attention to noise; meter practice in Paris; and a.c. measurement technique. The subjects down for discussion by the Transmission Section include the current rating of cables; high-speed protection of systems; the surge protection of transformers; and the "ripple" control of loads. A topical lecture by Dr. Johannes Adolph is entitled "Recent Aspects of Electricity Distribution in Large Towns." Interference with radio reception (another subject of prospective legislation) is one of the topics coming before the Wireless Section. The Informal Meetings show a similar diversity of interest and, on the whole, the programme shows that the Papers Committee is receiving good material and encouraging the discussion of matters of more than merely technical interest.

London's Transport

SUPPLY engineers who lie awake at night thinking of peak loads should contemplate the plight of the suburban traffic operator and be thankful. The report issued this week by the London and Home Counties Traffic Advisory Committee shows again that for one or two hours a day London's day-time population moves *en masse* into and away from the city, while during the rest of the day the transport system is run for what is practically a casual traffic. The position is worsening and suburban local authorities are clamouring for increased facilities which it is extremely uneconomical to provide. The London Passenger Transport Board has been asked to construct a twelve-mile extension of its Kennington line as far as Epsom, but it points out that in conjunction with the L.N.E.R. and G.W.R. it is already carrying out a £40,000,000 programme and until this is completed it cannot finance further extensions. The Advisory Committee suggests possible means of meeting the situation, but does not seem hopeful of their adoption.

The Physical Society's Exhibition

THE Physical Society's Exhibition, which is reviewed by Mr. G. F. Shotter on page 47, is an exhibition in the truest sense of the word, because the visitor is able to concentrate on the exhibits without being conscious of elaborate display stands and forceful salesmanship. Indeed, there is an atmosphere of keen interest and friendliness, shared by both visitors and exhibitors. The visitor is only too aware that it is practically impossible to keep abreast of progress nowadays, and is, consequently, keen to learn all he can, while the exhibitor, freed from the anxiety that a competitor's stand may be much larger or more striking than his own, has the opportunity of demonstrating his apparatus with the knowledge that it can be seen and judged on its merits. This point is mentioned because it does not seem to have been appreciated by some exhibitors, whose stands appeared to be inadequately staffed and at which practical information on new developments was not readily obtained.

Electricity Output

IN 1937 the quantity of electricity generated by authorised undertakings reached the high total of 22,905 million kWh, the year finishing well with 2,500 million kWh in December—the highest yet recorded for any month. A diagram published on another page shows the remarkable extent of electrical development in recent years; the total kWh generated last year was twice as much as in 1931. Although the 13.3 per cent. increase last year was below that in 1936 (15.1 per cent.), the actual amount represented was higher (2,694 million kWh as compared with 2,653 million kWh).

Tributes to Mr. Beauchamp

MR. J. W. BEAUCHAMP proved himself to be still an inveterate electrical developer (in spite of his candid confession of a leaning towards the coal fire) at a dinner given in his honour last Tuesday (see page 61). The tributes paid to him by Mr. R. P. Sloan (the chairman) and Mr. A. F. Berry, and the way in which the company received them, proved "J. W. B." to be held in the highest esteem and affection. We wish him happiness and health in his retirement and feel sure, after seeing him on Tuesday, that he will enjoy both.

Large-scale Pea Canning

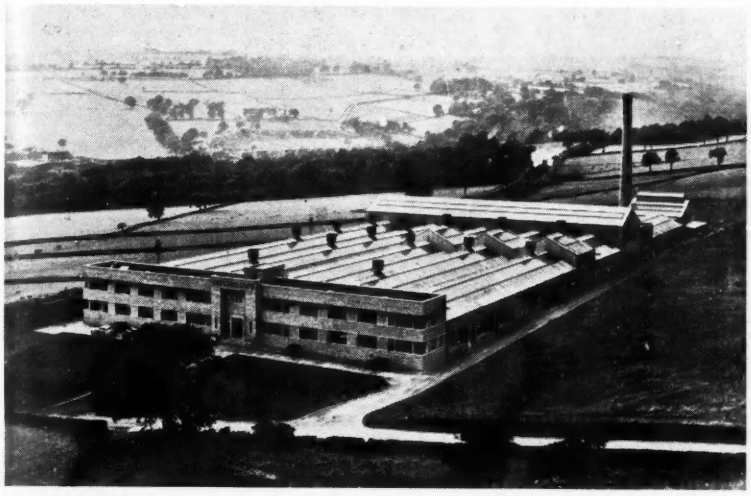
A new Yorkshire factory

Numerous small motors are employed in "keeping things moving" in this establishment where the food is untouched by hand

FROM the point of view of consumption the electrical installation at the new pea-canning factory at Wadsley Bridge, Sheffield, of Batchelor's Peas, Ltd., may not at first be impressive, but it emphasises two important aspects—the indispensability of electric driving in canning processes during which the food is untouched by hand, and also the economical operation of food-preparation machinery afforded by the electrical drive. Situated 4¼ miles from Sheffield on the L.N.E. Railway, the factory is laid out for an output of 1½ million cans of peas per week on an eight-hour day basis. The motors vary in size from fractional h.p. to 6 h.p., while the total h.p. installed is only about 200.

Sun-dried peas are canned and packed all the year round, and fresh garden peas are canned when in season. The three-acre building is bordered at one end by a suite of offices, at one side and the other end by railway sidings and at the other side by a roadway.

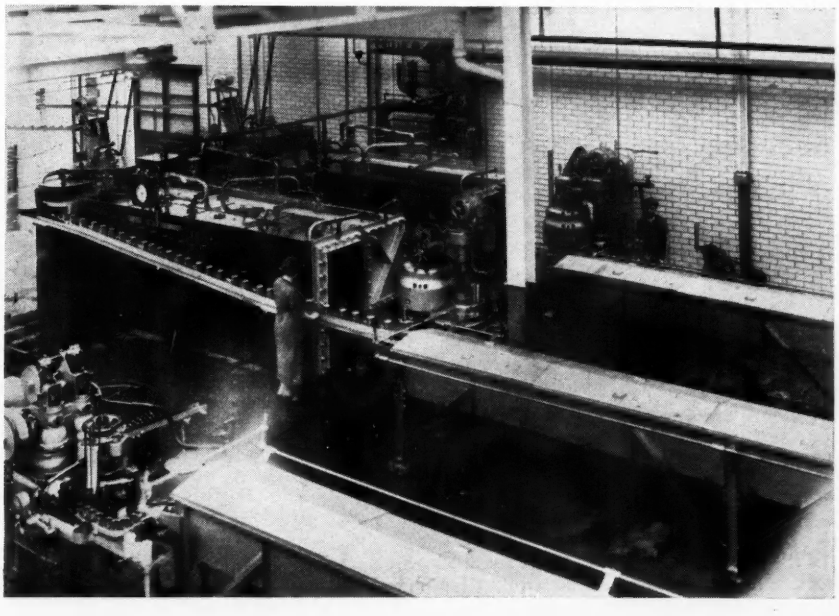
The dried peas are delivered either to the basement from



Batchelor's pea cannery at Wadsley Bridge

which they are transported to a first-floor pea-picking room by a Redler elevator, or they are hoisted direct to the picking room and deposited at any point by a Morris travelling crane which runs from end to end of the room. This crane is fed from any of nine plug points along the wall by a trailing cable. Each plug point consists of a water-tight screw-on plug and socket attached to an ironclad switch-plug. The peas are first fed to an automatic picking machine which consists of ten revolving drums on the inner surfaces of which are a large number of sharp needles which "catch" the damaged peas. From the needles the damaged peas are brushed to a central trough from which they are delivered to one or two bags at the end of each drum, the other bag receiving the good peas.

The whole battery of drums is driven by a 1-h.p. motor *via* a common belt-driven shaft. A 1-h.p. motor drives a horizontal conveyor which feeds all the drums and a 2-h.p. motor serves the feeding elevator. After further treatment on hand-picking tables the peas are delivered



Automatic pressure cookers, seaming machines, and exhaust boxes

via floor trap doors and travelling chutes into soaking tanks on the ground floor in which they are treated for several hours.

The water in the soaking tanks is also a washing medium and is cleansed continuously by circulation through a filter by means of a 3-h.p. motor-driven pump at the rate of 56 gal. per minute. Under valve control the soaked and cleansed peas are delivered to flumes from which, in the water stream, they flow to a perforated bucket elevator system for delivery to blanchers. Each blancher consists of a revolving drum with water at the bottom and steam at the top. A 2-h.p. motor drives each blancher and its feeding bucket elevator. Thermostatic control for the steam feed is effected by Short and Mason control-gauge equipment.

At the other end of the blancher, with a chain drive off the blancher drum, is a revolving cage in which the peas are cooled by water sprays. From the cooler the peas are delivered to a wide endless rubber belt for inspection. This belt is driven by a 1-h.p. motor and it delivers peas to another bucket elevator by which they are conveyed to storage tanks for delivery to can-filling machines.

An Unusual Conveying System

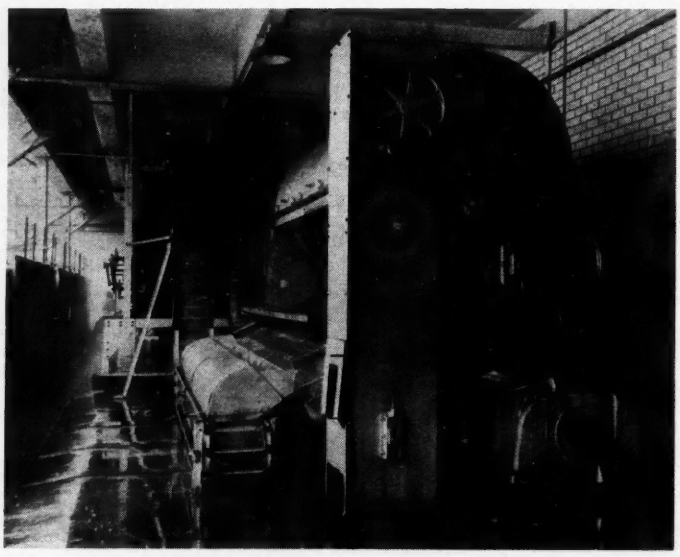
The operations so far described represent one of the three process flows which unite at the filling machines. The other two "flows" are the conveyance of empty cans from railway containers at the end of the factory and delivery of the brine solution which is also put into the cans with the peas. At the can unloading bay there are several portable can elevators which can be moved along the platform to suit the positions of the railway wagons. Each elevator is an angle-iron structure about 12 ft. high, and the small motor at the bottom has a short V-belt drive on to a pulley which serves the vertical carrier belt which, under spring influence, rolls the cans up the angle-iron guides from which, at the top, they roll on to a gravity chute which feeds a multiple runway inside the building and extending to the filling machines. The elevator motors are supplied by trailing cables from any of eight plug points along the unloading bay, each plug point consisting of a water-tight plug and socket angle unit screwed to an ironclad Simplex switch-fuse.

In each line of the runway there is an endless steel wire cable on which the cans "sit" and are carried between guides under their own "mass friction." One motor serves each three rope lines *via* chain-driven clutches, one or more of which can be released if necessary.

At the cannery end gravity chutes carry the cans to the

filling machines and the chutes are so arranged that the rope lines are interchangeable in respect of the filling machines which they serve. The brine solution is mixed in tanks on a platform above the filling machines, and the solution is fed to the machines by gravity under valve control. Each brine tank has a stirrer and the latest drive is a 1-h.p. motor which serves two stirrers through a belt-driven shaft and bevel gears. There is another travelling crane over this platform for handling the ingredients for the brine tanks, and this is also fed by plug and trailing cable.

The filled cans proceed from the filling machines in a single process flow and are first conveyed through exhaust boxes in which they are heated sufficiently to ensure that no air is entrapped with the peas. A 5-h.p. motor drives the elevator to the storage tank the filling machine and the conveyor system in the exhaust box. The filled cans next pass to lidding machines with independent drives of 2 h.p. and 3 h.p. which will deal with up to 120 cans per minute. The final operation of the canning proper is seaming in machines which turn the lips at the lid peripheries over the flanges of the can bodies.



[*Elec. Rev.* photo.

Milling machines (right) and winnowing machines

Cooking the Peas

Cooking is the next process, and this is done in steam-heated retorts into which and from which the crates of cans are lifted by electric cranes, or in high-pressure steam ovens through which the cans travel continuously by a tortuous path under the influence of a train of gear wheels. Conveyors carry the cans direct to each high-pressure oven, at the entry of which is a rotary sealing valve to which the cans are delivered individually by a short worm conveyor.

Each high-pressure cooker is in two sections, one for heating and one for cooling, and there are similar sealing arrangements at the delivery end of the heating section. The cans are steam heated to 240 deg. F., and the whole conveyor system in the two sections is driven by a 5-h.p. motor. A 2-h.p. motor serves a pump for the delivery of cold water in the cooling section. A 1-h.p. motor-driven elevator conveys the cans of cooked peas to the labelling department. Hot water from the retort cookers is delivered to a sump *via* sprays by a 14-h.p. motor-driven pump at the rate of 280 gal. per min. The water sprays are subjected to air cooling by 5-h.p. motor-driven fans.

The handling of fresh garden peas represents another process flow up to the storage tanks for the filling machines. In this case the peas are fed into a bucket elevator system which feeds a self-contained hulling machine with a 6-h.p. motor and short multiple V-belt drive. In this machine the peas are shelled between drums which revolve one against the other, and the peas roll out of the mesh container into a bucket elevator which delivers them to a 12-h.p. motor-driven winnowing machine for sorting and grading. The empty pods are delivered from one end of the hulling machine drum *via* an axially arranged chute. From the winnowing equipment the peas are delivered to the storage tanks where they join the common process flow.

Fruit canning is another branch of the company's business and although simpler in construction the equipment follows the same operating principles as that for pea canning. Fruit preparing machines such as apple scrapers are changed according to the season, but a 5-h.p. motor is in attendance for them all. An apple pulping machine is self-contained with its 2 h.p. drive.

At the time of our visit we saw prunes being canned in this particular department. A conveyor between stainless-steel picking tables delivers filled cans to a lidding machine from which they are passed to a continuous-flow normal-pressure steam cooker. The cans are then sealed in a 3-h.p. motor-driven machine and finally cooled.

In the labelling department machines which will each deal with 110 cans per minute are driven by ¾-h.p. motors. Each can runs over the roller of an electrically heated gum pot, picks up a label in which it enfolds itself and which is finally pasted down. The labelled cans are then packed into cartons the flaps of which are gummed before the cartons are fed between the spring loaded rollers of a belt compressor conveyor to ensure sticking. The belt compressor unit is driven by a 1½-h.p. geared motor.

Packing Dried Peas

In the packing of dried peas the peas are fed from the picking room through chutes to weighing machines which serve the filling equipment of which they are an essential part. Operated with the conveyor system of the filling equipment is a contact unit something like the drum of a motor starter. Each contact is actually made by the passage of a packet on the conveyor and the "making" of each contact releases the load of the electrically driven weighing machine above, so that the packet is automatically filled.

There are six weighing machines in this equipment and the whole will fill to correct weight ninety packets per minute. All the six weighing sections of the machine are driven by a 1-h.p. motor. Folded packets are fed to the filling section of the machine, which opens, fills, gums and seals them. The filled packets are placed in cartons, which are also finally sealed.

There are also a number of hand-filling machines in this department, but these are served by electric weighers. Soda-envelope making machines cut out, fold and gum the envelopes at the rate of 140 per minute, and soda-packing machines with 1-h.p. motor drives have capacities up to 70 packets per minute. The factory is space heated by fan-circulated steam heated "Thermolier" equipments.

All the motors from 1 h.p. to 5 h.p. are controlled by push-button governed contactors, while the larger units are served by star-delta starters. In those cases where sequence feeding from one machine to another is involved emergency stop buttons are provided at strategic points.

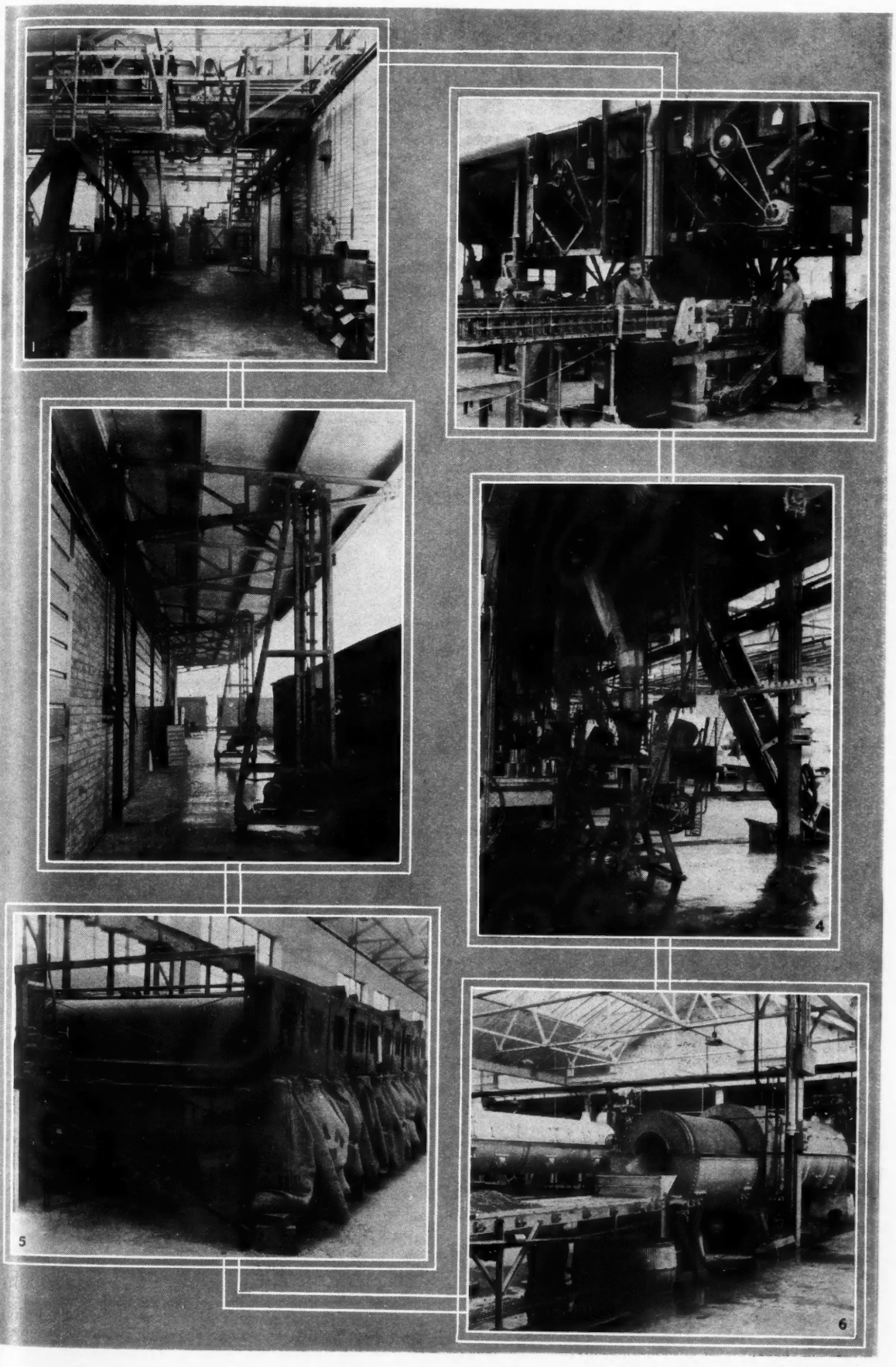
In the canning sections proper where there are considerable steam and moisture, enclosed-ventilated motors are employed with Donovan automatic starters. Practically the whole of the wiring for both power and lighting is Callender's cable in screwed conduit. Two incoming Ellison oil circuit-breakers provide for the main power distribution, while the 500 lighting points are served by a distribution board with English Electric switch-fuses. A good deal of the equipment, including the garden peas installation, the blanchers and the high-pressure cookers, was supplied by Mather & Platt, Ltd.

Indian Electrical Notes

THE Government of Bihar has made substantial progress in formulating a scheme of rural electrification in consultation with Sir William Stampe, who has now retired from the U.P. service. Funds have been sanctioned to carry out a preliminary survey, and the necessary staff has also been appointed. The estimated cost of the scheme will be Rs.3 crores. The Government has given up the original idea of confining the scheme to a tube well water supply and is now contemplating a supply of electricity throughout the province for industrial and domestic purposes. It is probable that the chief power station will be opened in the coal fields. The question of utilising the Hundru Falls is under examination. The scheme will be financed by Government through loans.

The Government of India has worked out a scheme, with a view to including it in the next Budget, for the installation of three telephone and four telegraph carrier channels between Bombay and Karachi at a cost of Rs.7 lakhs. Construction will be expedited so as to bring the scheme into operation by the end of 1938.

A committee has been appointed to inquire as to how far the reduction of electricity charges is feasible. There is also a demand for the reduction of telephone charges in Bombay.



[*Elec. Rev. photos.*

Views of Batchelor's Pea-canning Factory (See preceding pages)

1. Drives for multiple runway at cannery end. 2. Automatic weighing and filling machines in dried-peas department. 3. Portable can-unloading elevators, showing trailing cable feeds. 4. Line of filling machines. 5. Automatic dried-peas sorting machine. 6. Blanching machine (right) and inspection table for delivery to fillers

Low-voltage Switchgear.

By R. T. Lythall

Further problems

IN a previous article* some of the difficulties attending the operation of switchgear on low-voltage systems, particularly in dealing with high values of short-circuit, were outlined and the desirability of sectionalising in order to limit the short-circuit kVA at any point was discussed. It was further pointed out that, even with sectionalising, it is still necessary to limit the total plant feeding into a section, as otherwise the object will be defeated.

Additional advantages are to be obtained by such procedure in two directions: (1) Limiting the plant capacity per section avoids the need for extra-heavy-current switchgear. (2) The use of a number of smaller units of plant instead of one large unit provides for alternative supplies.

The annual reports of the Electrical Inspector of Factories entitled "Electrical Accidents" have emphasised the absolute necessity for adequate maintenance of switchgear, but with only one source of supply maintenance of the equipment controlling that source becomes almost impossible and duplication is called for. It is, however, not so readily appreciated that the major difficulties—not so much, perhaps, of the user as of the manufacturer—are due to the use of extra-heavy-current switchgear. A 3,000-kVA transformer, unrelated to voltage, may not at first sight appear unduly large when compared with some of the units commonly installed on networks. Related, however, to the usual low-voltage system at 400 V the normal full-load current is of the order of 4,300 A. For the control of such a circuit equipment of 5,000 A rating is the minimum needed. Such equipment is not beyond the capability of manufacturers, nor for that matter is gear of twice this rating, but it is in its making that the problems arise.

A reduction of unit sizes and duplication of supplies is favoured by the author

Dealing with what may be termed the major item in any switch equipment, *i.e.*, the circuit-breaker, we are faced with a number of technical problems. First, there is the question of operation. A 5,000-A breaker must be of large size, its moving parts require effort in closing and the contact system demands considerable pressure between its fixed and moving elements. In general, it may be accepted that the majority of low-voltage circuit-breakers must be closed by hand (economy being responsible). It follows, therefore, that each part of the operating mechanism must be worked out closely to provide an easy closing stroke where effort is reduced to a minimum, but at the same time allowing for ready release by ordinary trip coil under overload or other tripping conditions. Further, it must be allowed that a condition may arise where the breaker is closed (or attempted to be) on to a short-circuit. The "making" current is 2.55 times the r.m.s. value and the electromagnetic stresses encountered are as the square of the current.

Considering the case of a 3,000-kVA transformer with a reactance of 6 per cent. we find that the r.m.s. short-circuit current $=3{,}000\times1{,}000\times100/400\times1.73\times6=72{,}500$ A approx. The peak value $=72{,}500\text{ A}\times1.414$, so that allowing for "doubling effect" the current becomes $72{,}500\times1.414\times1.8=185{,}000$ A approx. These values make no allowance for drop due to cables, joints and ratio of resistance to reactance.† This may be appreciable, but the forces due to currents of even half the above value must obviously be immense.

It is against these forces that the breaker must be closed under fault conditions, and it is essential that the operation should be carried through without hesitation. Many a good breaker has been destroyed due to dithering at the contacts producing sustained arcing, considerable gas formation and subsequent explosion. This then is the problem of the operating mechanism. It must also be remembered that the breaker itself has to be of sufficient mechanical strength to withstand the forces described.

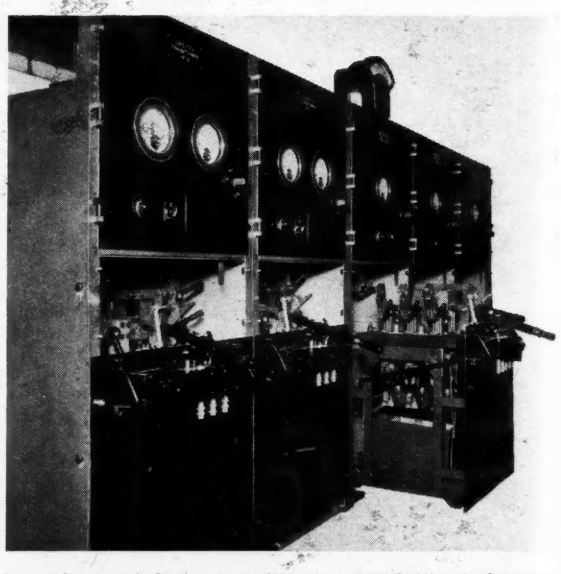
Secondly, there is the problem of the top plate. For currents above, say, 600 or 800 A it is essential to break up all magnetic circuits. For smaller breakers this may be satisfactorily accomplished by the use of non-magnetic inserts in an ordinary cast-iron or steel top plate. In the case of the heavier currents, however, recourse is necessary to a top plate cast in non-magnetic iron or to the use of a slate base, introducing again the problem of strength.

In the heavy-current breaker the third problem is the design of the main contacts. In general, a wedge and finger contact is not the most suitable for currents of 5,000 A. This type involves the use of a considerable number of fingers, introducing difficulty in first obtaining, and subsequently maintaining, consistent contact between these and the moving contact bar. Consequently, designers go to the wound-brush form of contact, which allows for variation in the relative positions of the brush mounting and the contact blocks, in that such variations do not affect to any extent the contact of the individual leaves forming the brush.

The next item in the equipment to which attention must be drawn is the isolating switches. In dealing with large currents these present several problems, the chief of which relates to the obtaining of efficient contact between blades and contact jaws. This cannot be guaranteed without recourse to jaw tightening devices, a cumbersome yet essential detail. Then follows the problem of operation. It is generally agreed that where possible a ganged switch is preferable to a single-pole-operated unit. To gang three isolators of 5,000 A each, however, would require disproportionate operating mechanism and the single-pole type is commonly used. At these high currents the position is complicated by the need, with pole-operated types, to open the switch blade by blade—a laborious task. In designs of isolator using a through conductor the problem of the magnetic circuit arises in much the same way as in the breaker.

Thirdly, we have the problem of bus-bars and connections. Here arise a multiplicity of difficulties each complex in itself and so readily leading to unexpected snags in service. Every joint in a heavy-current installation is a potential source of trouble. How best to support the mass of copper, how best to dispose the bus-bars and the formation of them, and how to avoid the ever-recurring problem of closed magnetic circuits are the chief questions.

Heating forms a major problem, which is the more difficult by reason of the variations which occur in bus-bar formation. Up to certain current ratings bus-bars of laminations placed side by side on edge, with spaces equal to the thickness of the strip between them, are satisfactory. Beyond this, however, due to skin effect, any increase in the number of laminations results in no appreciable increase in carrying capacity.



Low-voltage switchgear controlling two 1,000-kVA transformers and three outgoing feeders

In a treatise on "Copper for Bus-bars" issued by the Copper Development Association (No. 22), it is stated that in general very little increase in capacity can be gained by using more than eight laminations in one group. Curves are given to show that in a bar consisting of ten laminations the current density in the outer strips is about four times that in those at the centre, the two centre laminations together carrying only about one-tenth of the total current. This and other considerations render it necessary to adopt some other form of bar such as a parellel bank of laminations suitably spaced apart, the "hollow square," tubular and others. The sup-

* "Low-voltage Breaking Capacity," by R. T. Lythall. ELECTRICAL REVIEW, April 30th, 1937.

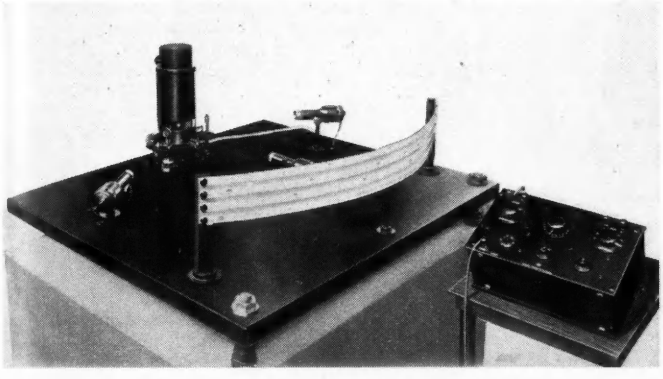
† "Calculating Fault Currents," by C. J. O. Garrard. ELECTRICAL REVIEW, September 24th, 1937.

Instrument Progress. By G. F. Shotter

Noteworthy items at the Physical Society's Exhibition

THE exhibits at the Physical Society's Exhibition are always numerous and varied in their interest. A first impression of a visit to certain manufacturers' stands last week was that a great deal of attention has been paid to apparatus concerned with the Electricity Supply (Meters) Act, 1936. Indeed, from the concentration on this type of exhibit, a complete stranger might justifiably have come to the conclusion that a Meter Department in which proper standards of accuracy were observed never existed before the passing of this Act. For the benefit of those not directly concerned with this matter, it might be as well to point out that instruments having the required degree of accuracy and characteristics were both obtainable and used years before the Act was ever considered. On the other hand, the Act has resulted in the standardisation of meter-testing instruments and their ranges on a logical basis, and from this point of view alone has been a big step forward.

A striking exhibit, appealing particularly to the meter engineer, was the reflecting wattmeter shown by the Cambridge Instrument Co., Ltd. (illustrated). A feature is its scale, which is 2.5 metres long and is arranged in three parallel strips. Three suitably placed lamps and optical systems are used to produce an image of the wattmeter mirror on the scale, the first on the upper section of the scale, the second on the centre section and the third on the bottom section. As the reflected image on the upper scale attains full deflection, another image provided by the second lamp appears at the beginning of the centre scale and, similarly, a third image appears on the beginning of the bottom scale when the spot on the centre section attains full deflection. This is a highly ingenious method of obtaining a long scale and the company deserves congratulations on this development.



Cambridge reflecting wattmeter with 2.5-metre scale

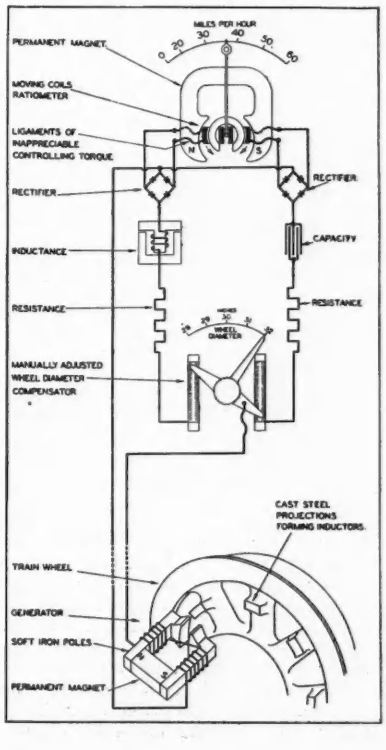
The wattmeter is of the quartz suspension type with oil damping. The current coils are carried on a special nickel-iron alloy system, enclosing the suspended moving coil within a shielded annular gap. It is claimed that this iron-clad design eliminates the effect of external stray fields and provides a long linear scale with high electromagnetic efficiency. The accuracy of this instrument is one part in 2,000 over three-quarters of its scale as compared with the one part in 1,000 over the full scale of the best type of 12-in. scale pivoted instrument. It is sufficient to say that two of these reflecting wattmeters are being installed at the N.P.L.

Generally speaking, most of the manufacturers showed either one or both of the two types of sub-standard wattmeter, namely, the special and ordinary types, to which only minor modifications or none at all have been made, such as additional ranges and effective screening, &c., to bring them within the requirements of the Act. However, a useful application of an aid to accuracy well known to old hands, namely, a magnifier with lamp, to facilitate reading the scale, was shown incorporated in a wattmeter exhibited by Everett, Edgcumbe and Co., Ltd.

Various types of Class AL multi-range current transformers suitable for operation in conjunction with sub-standard wattmeters were also being shown. Two concerns, Elliott Bros., Ltd., and Everett, Edgcumbe and Co., Ltd., have introduced a switch to facilitate selection of the current ranges and to eliminate so far as is possible accidental damage to the transformer due to the open circuiting of the secondary. The value of such switches is only fully appreciated by those who use them. This development is, in part, due to the aforementioned Act. The potentiometer seems to have been regenerated, but there appear to be no developments worthy of mention, these mainly consisting of slight modifications to enable the instruments to comply with the new requirements.

A rather interesting development in connection with bridges is the low resistance comparison bridge due to Mr. D. C. Gall. This instrument, which can be used instead of the Kelvin double bridge, is extremely simple to operate and is readily checked. Unequal ratios can be used and thermo-electric effects are eliminated by current reversals.

A moving-coil instrument of novel design, shown by Nalder Bros. and Thompson, Ltd., employs a nickel-aluminium cobalt steel core in place of the soft iron core usually used in such instruments, the magnet circuit being completed by two soft iron pole pieces joined by a soft iron yoke. Not only does this development enable a very compact in-



Inductor type railway speed meter

Low-voltage Switchgear (*Continued from previous page*)

porting of heavy-current bars is no easy matter, bearing in mind the conditions which are set up during short circuit.

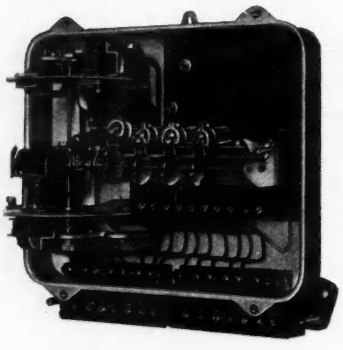
Considerable local heating can be caused by a single bad joint or bad contact making surface. Copper contact surfaces, working at reasonably high temperatures, suffer appreciably due to oxidation, whether they are in air or oil, and copper oxide having a high resistance, seriously affects the efficiency of contacts. This effect is obviously greater in heavy-current equipments operating somewhere near the design temperature limits. Once started, the formation of oxide offers a splendid example of the vicious circle—oxide forms, contact resistance rises causing further heat, oxide formation is further accelerated and so on. The effect on the temper of springs and contacts is clear and, in general, many of the heating troubles in heavy-current gear may be traced to this cause. Where only one source of supply is available and the circuit-breaker must remain closed for long periods without operation the removal of oxide formation by wiping action at the contacts in opening and closing is prevented.

Thus the main problems of heavy-current low-voltage gear depend for their solution on the reduction of unit sizes and duplication of supplies, and an example of low-voltage switchgear controlling two 1,000-kVA transformers and three outgoing feeders is shown in the photograph, for which acknowledgments are due to Standard Telephones & Cables, Ltd., and to Johnson & Phillips, Ltd. This arrangement, although slightly more expensive than if one 2,000-kVA transformer and switch had been adopted, provides for duplication and for sectionalising later when further additions are necessary. One transformer equipment can be taken out of service for maintenance, an operation rendered easier by the provision of withdrawable breakers. Withdrawal is accomplished, after opening the breaker and isolators, by unclamping the swing-over links, the difficulty of making withdrawable isolating devices for heavy currents being obviated.

strument to be produced, but one which should have advantages over the older type with regard to the effects of any stray field. These instruments are being made with dials having diameters from 1½ to 12 in. with 120 deg. and 260 deg. scales.

The torque with this construction is high, this being approximately 20 grm.-cm., and the development is being applied to all d.c. moving-coil instruments. A novel example of such an application was an instrument in which the pointer, instead of being pivoted at the centre of the movement in the usual manner, was arranged to move over a flat horizontal scale.

An instrument of interest to radio and television engineers was the new Weston analyser, which combines in one device the measuring facilities for present-day radio requirements and the basic requirements of television servicing. Its sensitivity on all of the d.c. ranges is 20,000 ohms per volt, and on all of the a.c. ranges, 1,000 ohms per volt.



Londex power-factor regulator

A very fine range of instruments was shown on the Marconi-Ekco stand. This included a circuit magnification meter for the measurement of the magnification and inductance of coils, the power factor, capacity and inductance of condensers, the dielectric loss of insulating materials, and the effective resistance and phase angle of resistors. These measurements may be made in the range 50 kc to 50 Mc. Brief reference may also be made to this firm's integrating accelerometer, which gives a direct reading of a totalised value representing the time in which acceleration in a particular direction exceeds a predetermined value. A point of interest to the meter engineer is that an integrating a.c. watt-hour meter is used as the means of integration. It is to be hoped that this meter has been duly "approved" and "certified"!

The combined efforts of Messrs. Everett, Edgcumbe & Co., Ltd., and Evershed & Vignoles, Ltd., have resulted in the production of an inductor type railway speedmeter, the general principles of which will be apparent from the diagram on the previous page.

Ferranti, Ltd., showed a new live-line tester, which provides the means of obtaining the potential distribution along an insulator string and enables the immediate detection of a faulty unit. A point which occurred to the author was that a "telescopic" eye might be an asset to the operator, particularly when using the instrument on 132-kV lines. A companion instrument to this is a joint tester developed by Everett, Edgcumbe & Co., Ltd., for the Central Electricity Board. It consists of a millivoltmeter operated from a small transformer, the instrument providing two ranges, namely, 0-20 and 0-100 mV. The instrument is mounted on a suitable insulating pole.

Oscillographs

One interesting development among the various types of oscillographs shown was an instrument, due to Prof. B. F. J. Schonland, exhibited by A. C. Cossor, Ltd. Automatic brilliancy control is obtained in this instrument, and it is claimed that it completely overcomes the varying contrast on photographic records containing both high and low frequencies, the beam current being kept low for low-frequency potential fluctuations, and automatically raised to the right value to record high-frequency surges. The device also prevents the burning of the fluorescent screen when high-current beams move at low velocities. The same company also showed a double-beam oscillograph, which can be used to show or record two wave forms simultaneously. The X deflecting plate is common to both beams, so that the time base operates on both of them simultaneously.

A photo-electric high-speed recording pyrometer, exhibited by the Foster Instrument Co., Ltd., is worthy of mention. It consists of three assemblies, the transmitter, amplifier and recorder, and has provision for additional indicators and recorders, &c. The instrument is intended for use in indicating and recording temperatures in excess of 800 deg. C., and has been designed primarily for use on rolling mills and similar applications necessitating the accurate recording of the temperature of moving objects, such as ingots, billets, rails, &c. Advantages claimed for the apparatus are that it is both self-calibrating and self-adjusting.

Two extensions in the range of the well-known Evershed & Vignoles "Megger" type instruments have been made. The first consists of the production of a 5,000-V "Megger" testing set, having two ranges, 0-2,000 megohms and 8-20,000 megohms. The weight of the instrument is approximately 60 lb., and it is provided with two carrying handles. The other development is a new low-range earth tester, the lowest range of which reads 0-1 ohm, special arrangements being made to obtain accurate results by means of compensation for variations in the resistance of the potential spike.

From the point of view of the supply engineer, two instruments to be noted were shown by Londex, Ltd. One of them was a power-factor regulator incorporating a three-phase sine meter driving a series of cams which, in turn, operate a number of mercury switches to put in or out of circuit the requisite number of power factor correcting condensers. It will be obvious that if true unity correction were desirable, then the meter would be arranged as a true sine meter in which the direction of rotation would be such as to open the switches in turn on a leading p.f. and close them on a lagging p.f. by the reversal of the direction of rotation. This device should prove of considerable value in the case of factories using correcting condensers and being charged on a kVA basis.

The other instrument was a novel type of maximum demand alarm unit incorporating a watt-hour meter element mechanically coupled through a differential gear to a Ferraris motor, the speed of which can be adjusted by the consumer. The scale provided is calibrated in kW or kVA as required. The planet wheel of the differential is coupled to a contact-making device operating an alarm circuit. In use, the two motor units work in opposition through the differential, and in the event of the meter rotor exceeding the speed of the externally adjustable motor, the alarm will be given.

Reference should also be made to the selenium type rectifier, seen on the Standard Telephone & Cables, Ltd., stand, and the future development of this type of rectifier will no doubt be interesting to follow.

Research

A visit to the Research Section always leaves a reviewer in a quandary. Apart from gaining an impression of his own ignorance of the progress which is being made, he is faced with the problem of paying adequate tribute to the very fine work which is being carried out in so many directions. Consequently, brief attention can only be drawn to points of particular interest to the reviewer.

Professor Catterson-Smith's demonstration of the theory and measurement of the symmetrical components of unbalanced voltages and currents in three-phase circuits would seem to warrant wider publicity in order that those interested in protective devices and investigating the properties of three-phase circuits should reap the full benefit of his work.

Of two interesting developments shown by the British Thomson-Houston Co., Ltd., one was a shield grid thyratron suitable for peak currents of 75 A, and peak voltages of 2,000 V, the tube being controlled direct from a photo-cell without amplification. The other was a portable recurrent surge oscillograph which renders visible the effect of surges upon electrical plant.

Another exhibit noted was a voltage stabiliser shown by Ilford, Ltd. This employs a barretter, a thermionic valve, and a "Stabilovolt" tube. The device has an input voltage of 230 V and an output voltage of 140 V, with a maximum current of 30 mA.

A link with the past was provided by a spectacular exhibit shown by Mr. A. Mortimer Codd. This new electrostatic generator of the Töpler-Voss-Holtz type, delivering 100,000 V to the accompaniment of both visible and audible phenomena, was described in the ELECTRICAL REVIEW of December 24th, 1937.

I may conclude by saying that I was very pleased to note that the usual high level of work shown in the apprentices' section was fully maintained.

Further Extensions at Hams Hall

The construction of a second generating station on the Hams Hall site is proposed, according to the *Birmingham Post*. A sub-committee of the Electricity Committee of the Birmingham Corporation is presenting a report at the next Council meeting recommending that the total capacity installed on the site shall be increased to 550,000 kW at an ultimate cost of £8,000,000. Prompt action is to be urged. On the grounds of the importance of obtaining adequate supplies of condensing water as well as for technical administrative reasons, the Electricity Committee regards the present site as the most suitable. In order to meet the Air Ministry's views regarding danger from air raids, the new station would be situated about 700 yd. from the existing Hams Hall station and would be made proof against damage by bomb splinters.

Trolley-buses in Manchester

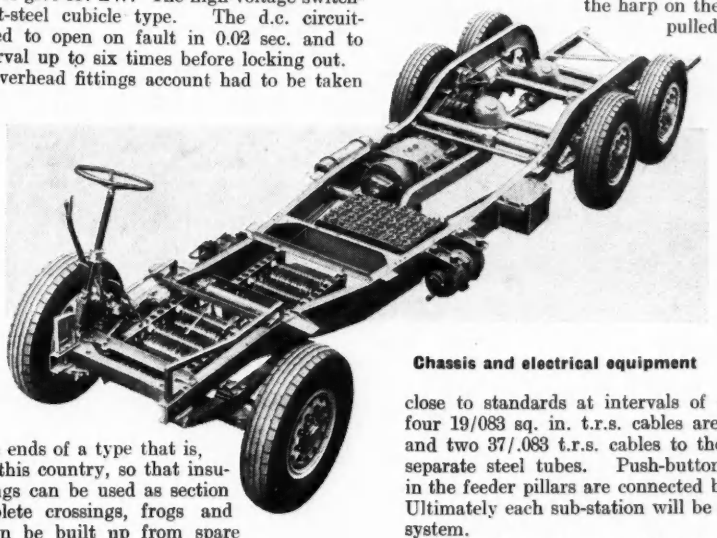
A description of the system which is shortly to be inaugurated

WITHIN the next few weeks trolley-buses will for the first time run in the streets of Manchester. The two routes to be served are the Ashton New and Old Roads, which converge at their eastern ends, from which point the Old Road route is continued to Ashton-under-Lyne and Stalybridge. A total of fourteen route miles is being equipped and the service will be worked jointly by the Manchester Corporation and Ashton-under-Lyne Transport Departments.

Although the two routes are linked to form a closed electrical circuit, each has its own termini and turning circles and will be operated independently. Initially, there will be two isolated electrical sections, a smaller in the city area fed from Dickenson Street station and a larger fed from eight normally interconnected sub-stations spaced approximately one mile apart. Five of the sub-stations are new brick buildings designed by the Electricity Department.

Each sub-station is supplied from two sources at 6.6 kV. Rectification to 600 V d.c. will be by two six-anode glass-bulbs connected in parallel to give 357 kW. The high-voltage switchgear is of the sheet-steel cubicle type. The d.c. circuit-breakers are designed to open on fault in 0.02 sec. and to reclose after an interval up to six times before locking out.

In the design of overhead fittings account had to be taken of the need to ensure smooth running across complicated junctions due to the operation of tramcars on adjacent routes. Overhead work, including feeder and section pillars, is being carried out by the electrical staff of the Manchester Transport Department, who have designed fittings with interchangeable ends of a type that is, we believe, new to this country, so that insulated parts of crossings can be used as section insulators and complete crossings, frogs and section insulators can be built up from spare parts.



Chassis and electrical equipment

The trolley wire is held in position in a groove in the section insulator by two screws which are forced home by gouging into the top of the wire. Grooved cadmium-copper of 4/0 s.w.g., Portsmouth section, is being used; this has a slightly wider spread on the running side than standard grooved wire, thus tending to prevent the collector from rubbing the sides of fittings at suspension points. The collector is of the shoe type with a carbon block insert which is expected to reduce dewirement, sparking, noise and interference with radio. It also provides a larger contact surface than does a trolley wheel. The carbon block and bronze shoe form a unit that can swivel horizontally and vertically in a malleable-iron harp. The electrical circuit is from the carbon through the shoe to the harp and then through a sleeve inside the pole, which is insulated from it by a rubber sleeve to the cable socket. The collector head is clamped to the trolley pole by the tightening bolts and is further held by a link anchored to a bracket which is clamped over the sleeve and the rubber insulating sleeve. This bucket has also a lug which locates the harp on the pole. Should the head be pulled off, it is prevented from falling on the road by a rope.

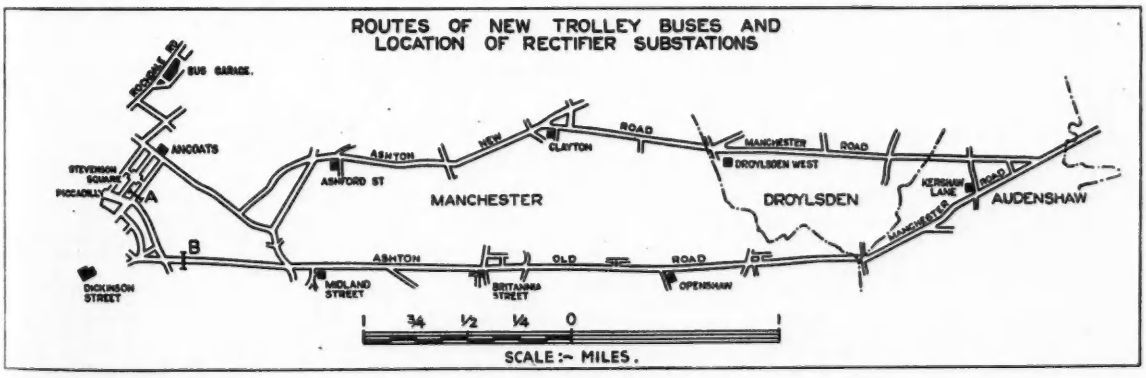
A trolley-bus undergoing tests in a Manchester suburb

Poles 18 ft. 9 in. long are fitted to both sides of the bus and allow a total lateral movement of about 24 ft. They are mounted on bases the levers and sockets of which are made from steel stampings. The leads from the bases go to roof-mounted dual-wave radio-interference suppression coils.

Feeder and section pillars have been installed close to standards at intervals of about a mile. From each four 19/083 sq. in. t.r.s. cables are connected to the positive and two 37/.083 t.r.s. cables to the negative trolley wires in separate steel tubes. Push-button make-and-break switches in the feeder pillars are connected by pilots to the sub-station. Ultimately each sub-station will be controlled on a supervisory system.

Automatic couplers are fitted in the section pillars so that all sub-stations can supply any one section without undue voltage drop and regenerated power which cannot pass back through the rectifiers, is more easily absorbed in the system. At first the negative wire will be earthed, but the system is laid out with later all-insulated operation in view.

A garage has been built at Rochdale Road, Manchester, close to the centre of the city, to house 105 trolley-buses and also to provide accommodation, including an electric canteen, for the staff. In all, 76 vehicles have been ordered, half with three axles and 68 seats and half with two axles and 56 seats. Forty chassis are by Crossley Motors and thirty-six by Leyland Motors, the first-named concern supplying all the bodies with Metropolitan-Cammell-Weymann steel structures. The



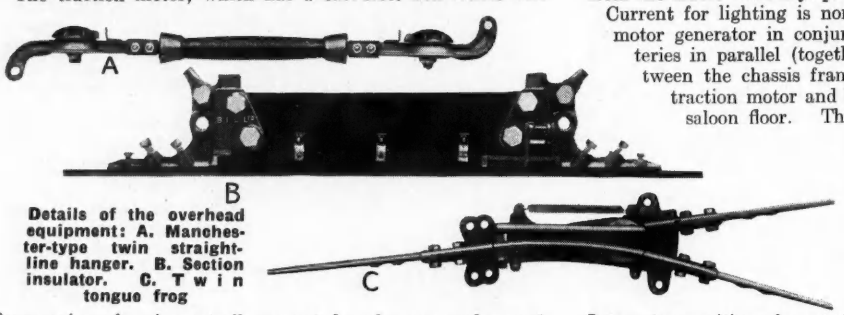
The trolley-bus routes

Metropolitan-Vickers Electrical Co., Ltd., was responsible for the main electrical equipment. No parts of the body frame and chassis are welded.

Four brakes are provided: regenerative, rheostatic, compressed air and hand operated. The first comes into action whenever the controller pedal is slowly released after power has been applied by the left foot, and provides smooth control down to 12 m.p.h. If the pedal is returned quickly to the off position this brake does not operate and the vehicle coasts, but if it does not quite reach that position or if a voltage greater than 680 is generated, a relay disconnects the motor from the line and institutes rheostatic braking.

Normally, the rheostatic brake is applied by a pedal operated by the right foot and is effective down to 3 or 4 m.p.h., at which speed the Westinghouse air brake is also in operation for stopping the vehicle. The motor driving the air compressor for the last-named is wound for line voltage.

The traction motor, which has a cast-steel box frame and four main poles, is centrally mounted and compound-wound for regeneration and carries a speed indicating a.c. generator on an extension to its shaft; on the three-axle vehicles it is of 90 h.p. on the two-axle type 80 h.p. Class B insulation is used throughout and the armature shaft runs on roller bearings with a thrust bearing at the driving end to take spline end thrust.



Details of the overhead equipment: A. Manchester-type twin straight-line hanger. B. Section insulator. C. Twin tongue frog

A fan draws a volume of cooling air axially from the commutator across the surface of the armature and field coils and also through longitudinal ducts in the commutator and armature and then expels it radially.

The controller consists of a series of double-break silver contactors which are operated in sequence by means of a lever operated through links from the power pedal. As the contactors are in the control circuit of the main contactors they break only small currents. In the lower part of the controller is the reverse—a simple drum switch—which is prevented by mechanical interlocks from functioning when power is applied. Interlocks also prevent depression of the power pedal unless the reverse switch is in the trolley-operating position.

The main contactors are electro-magnetically operated, the coils being energised from the line, and are mounted in the driver's cab which extends the full width of the bus. Six notches are provided for cutting out series resistance during acceleration; five others weaken the shunt field and the last one introduces a diverter across the series field to obtain the maximum speed of 35 m.p.h. On releasing, the pedal regeneration is obtained by strengthening the shunt field. The main resistances are mounted under the cab and insulated from the frame with dry-spot insulation.

Current for lighting is normally obtained from a 600/30-V motor generator in conjunction with two nickel-iron batteries in parallel (together weighing 350 lb.) carried between the chassis frame side members in front of the traction motor and beneath a trap door in the lower saloon floor. The batteries can be connected in series for driving the bus off the main traffic routes in the event of a breakdown.

Testing for current leakage to the chassis (the maximum permitted by the Ministry of Transport is 2 mA) is carried out every day after service when the insulation is hot. Into a two-position plug at the rear of the vehicle is inserted a copper spade, which makes contact in the first position with the chassis, and in the second position with a number of fingers each connected to the frame of an electrical component. From the spade connection is made through a milliammeter and fuse to earth. During the test all auxiliaries are put into operation and the first notch of power applied.

Acknowledgments are due to Mr. R. S. Pilcher, general manager, and Mr. C. H. Grindrod, electrical engineer, Manchester Corporation Transport Department, as well as to Mr. H. C. Lamb, chief engineer and manager, Manchester Corporation Electricity Department, for facilities afforded us in the preparation of this article.

The I.E.E. Programme

The programme of the Institution of Electrical engineers for the second half of the session 1937-1938 has now been issued and is as follows:—

Ordinary Meetings

January 20th. "The Design of Domestic Electric Cookers." By O. W. Humphreys. "Electric Cookers for Domestic Purposes, with special reference to Maintenance Costs." By J. N. Waite.

February 3rd. "The Moving-Coil Voltage Regulator." (With a demonstration of apparatus.) By E. D. T. Norris.

February 10th. Annual Dinner. (At Grosvenor House, Park Lane, W.1, at 7 for 7.30 p.m.)

February 24th. "The Electrical Ignition of Mixtures of Ether Vapour, Air, and Oxygen." By Professor W. M. Thornton. "The Risk of Explosion due to Electrification in Operating Theatres of Hospitals. By E. H. Rayner.

March 10th. "The Lighting Load—Its Characteristics and Development." By W. J. Jones.

March 17th. "Recent Progress in Power Rectifiers and their Applications." By W. G. Thompson.

March 24th. "Plastics and Electrical Insulation.' (Joint Meeting with the Plastics Group of the Society of Chemical Industry.) By L. Hartshorn, N. J. L. Megson, and E. Rushton.

April 7th. "The Trend of Design of Electric Locomotives." By C. E. Fairburn.

April 21st. "The London Television Service." By T. C. Macnamara and D. C. Birkinshaw. "The Marconi-E.M.I. Television System." By A. D. Blumlein, C. O. Browne, N. E. Davis and E. Green.

April 28th. The Twenty-ninth Kelvin Lecture. "The Statistical Laws of Nature." By Professor Max Born.

May 12th. Annual general meeting. Faraday Lecture on "The Evolution of Electrical Power." By Dr. A. P. M. Fleming.

Meter and Instrument Section

January 7th. "The Calibration of Sphere Gaps with Impulse Voltages." By R. Davis and G. W. Bowdler. "The Calibration of the Sphere Gap for Voltage Measurement up to One Million Volts (Effective) at 50 Cycles." By F. S. Edwards and J. F. Smee.

February 4th. "An Objective Noise-Meter for the Measurement of Moderate and Loud, Steady and Impulsive Noises." By A. H. Davis. "The Circuit Noise-Meter (Psophometer) and its Applications." By H. H. Harbottle.

March 4th. To be announced.

March 18th. Informal discussions on "Meter Practice in Paris." (Opened by Mr. A. M. Strickland), and "The Future of Meter Testing."

April 1st. To be announced.

May 20th. "New Measurement Technique, with particular reference to Alternating Current Measurement." By Professor Georg Keinath.

Transmission Section

January 19th. "Current Rating of Cables for Transmission and Distribution." (E.R.A. Report.) By S. Whitehead and E. E. Hutchings. "Current Rating and Impedance of Cables in Buildings and Ships." (E.R.A. Report.) By H. C. Booth, S. Whitehead, and E. E. Hutchings.

February 16th. "High Speed Protection as an Aid to Maintaining Electric Service following System Short-Circuits." By T. W. Ross and C. Ryder.

March 9th. "Recent Aspects of Electricity Distribution in Large Towns." By Dr. Johannes Adolph.

April 13th. "The Surge Protection of Power Transformers." By J. L. Miller and J. M. Thomson.

May 11th. "Centralised Control of Public Lighting and Off-Peak Loads by Superimposed Ripples." By H. Purslove Barker.

Wireless Section

January 5th. "A Theory of Fluctuation Noise." By D. A. Bell.

February 2nd. "A Resonance Bridge for use at Frequencies up to 10 Megacycles per Second." By Professor C. L. Fortescue and G. Mole.

March 2nd. "A Quantitative Study of Asymmetric Sideband Broadcasting." By P. P. Eckersley.

April 6th. "Electrical Interference with Radio Reception." By A. J. Gill and S. Whitehead.

May 4th. "Researches in Radio Telephony." By Dr. Ralph Bown.

Also Informal Meetings (Tuesdays, 6.30 p.m.): January 25th, March 15th.

Informal Meetings

January 10th. Discussion on "Electricity in the Catering Industry." (Opened by Commander F. T. Hewson, R.N. (Ret.).)

January 24th. Discussion on "The Routine Testing of Protective Gear." (Opened by Mr. G. H. Fowler.)

February 14th. Discussion on "Electric Radiators of the Heat-Storage Type." (Opened by Mr. W. L. Shand.)

February 28th. "Discussion on "The Widening Scope of Electrical Meters and Instruments." Opened by Mr. G. F. Shotter.)

March 14th. Discussion on "High Tension Direct Current." (Opened by Mr. W. E. Highfield and Mr. J. E. Calverley.)

March 28th. Discussion on "Engineering Economics in Planning." (Opened by Mr. F. Gill, O.B.E.)

April 11th. Discussion on "Air Conditioning." (Opened by Mr. R. J. C. Barrington.)

The "Orthojector" Circuit-breaker

Extra-high breaking capacity

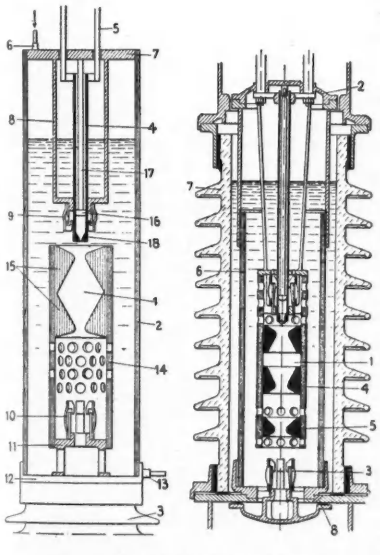
THE "orthojector" circuit-breaker shown by the Ateliers de Constructions Electriques de Delle at the International Exhibition, Paris, is designed for a breaking capacity of 5,000,000 kVA at 500 kV, and is claimed to be the most powerful in the world. Its construction represents an advanced application of the principle of restricting the amount of oil to that required for satisfactory interruption of the circuit, ceramic material being used instead of oil for the general insulation of live parts.

Although about 39½ ft. high, its chambers contain only 44 gal. of oil, compared with 16 tons in a tank-type circuit-breaker for 220 kV, and there are corresponding reductions in the equipment required for erection and maintenance. The practicability of the new construction depends upon the rapid extinction of the arc with minimum dissipation of energy, so that no excessive mechanical pressure is developed and the small quantity of oil present is not rapidly deteriorated.

Relatively little oil is used, the general insulation of live parts being by ceramic material

The condition for rapid extinction of the arc is that the voltage required to re-strike it, after the passage of current through zero, is higher than the voltage available at that moment. The voltage required to re-strike the arc can be increased by substituting an insulating space of high dielectric strength for the conducting gaseous mass of the arc. This substitution is easier, the less the amount of ionised gas present, *i.e.*, the smaller the energy dissipated in the arc and the more effectively the ionised gas is removed as the current approaches zero. It is claimed that all the conditions for rational extinction are fulfilled by the "orthojector" circuit-breaker, in which a combination of auto-extinction and low auxiliary energy effects satisfactory operation over the whole range of currents concerned.

The basic principles applied are as follows: (1) The contacts are separated to a distance depending on the restoring voltage before attempting extinction which could not, in any case, be effected until this minimum separation had been reached. (2) During the preliminary period (1) the energy dissipated in the arc is kept as low as possible by shortening the duration of the period (rapid separation of contacts) and keeping the length of arc a minimum (rectilinear motion). (3) As soon as the breaking distance is reached supplementary energy is produced to extinguish the arc at its next passage through zero. This is effected by bringing the arc into a chamber from which the gases cannot escape freely; the pressure developed sends a blast of oil and oil vapour along the whole length of the arc. (4) In order that reliable breaking may be obtained even when the current, and therefore the auto-extinguishing oil blast, is low a mechanical injection of oil is maintained. The small amount of auxiliary energy required for this can be taken from the main operating spring. The accompanying illustrations* show the constructional means by which these principles are applied.



Figs. 1 (left) and 2

Fig. 1 shows the blast chamber 1 of insulating material in an oil-filled container 2, carried by a stack of insulators 3. The tank 2 is about 7⅛ in. diameter and its height is 3 ft. 3⅜ in. for a 150-kV breaker. The moving contact is a tube 4, operated by rods 5. When the switch is closed, current enters at 6 and flows through the cover 7, support 8 and sliding contacts 9 to the tube 4, and thence *via* 10, 11 and 12 to 13. When the breaker opens an arc forms between 10 and 4, as in an ordinary circuit-breaker, the large openings in 14 permitting free escape of gases; this is the "preliminary period" mentioned in (1) above. As soon as the end of 4 is inside the chamber 1 the oil therein is vaporised and a blast is established through the lower nozzle 15. A certain amount of ionised gas is expelled at the same time and only a moderate pressure is developed in 1. As the current passes through zero, the axial jet of vapour and oil (supplemented by oil squirted from inside 4 by the piston 16) establishes such high dielectric strength in the gap that the arc is not re-ignited. The jet of oil through 18 has previously intensified the auto-blast action.

In "orthojector" circuit-breakers for voltages up to about 75-kV the blast chamber 1 occupies the greater part of the breaking length of the arc and no special guidance is required to keep the arc on the line of the blast. For higher voltages, however, a guide ring 5 (fig. 2) is fitted between the chamber 1 and the fixed contact 3. This drawing shows the breaking element of a 150-kV breaker; two such elements are used in series for 220-kV, and four in the 500-kV breaker. The bakelite tube 6 is protected from weather by the oil-filled porcelain tube 7, and two small holes 8 provide connection between the oil spaces inside and outside 6; actually, very little oil flows through 8 and the porcelain 7 is subjected to no appreciable oil pressure.

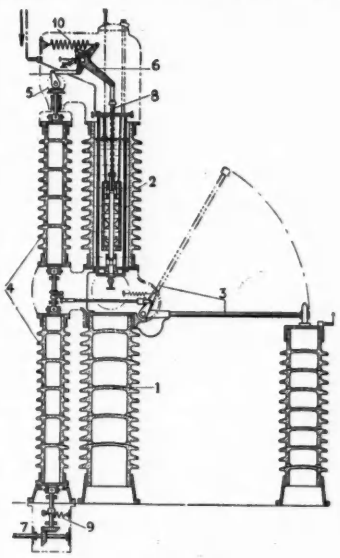


Fig. 3

Fig. 3 explains the operating mechanism of circuit-breakers of this type and the isolating switch which forms an integral part of the equipment. The insulation of live parts from earth is effected by stacks of porcelain insulators, the "diaphragm" construction of which prevents the possibility of breakdown resulting from internal condensation.

The circuit-breaker unit 2 (fig. 3) is mounted on a column 1 of diaphragm insulators, and the operating rod 8 is actuated by the "shaft" 4, consisting of two columns of insulators rotated by bevel gears from 7 and operating 8 through bevel gears 5 and a bell crank mechanism 6. When the breaker is tripped, the column 4 is rotated by a spring 9. As soon as the column has turned through a few degrees, the circuit-breaker mechanism is released from 4 and operated at very high speed by the spring 10. The column 4 meanwhile continues its rotation and in due course opens the isolating switch 3, the current flow having, of course, already been interrupted by the extinction of the arc in the circuit-breaker a few half-cycles after the contacts open. The operations are reversed to close the circuit.

Fig. 3 relates to a 150-kV circuit-breaker. For 500-kV, two columns of supporting insulators 1 are used one above the other, a second circuit-breaker unit 2 is mounted above the first, the actuating column 4 being similarly extended. A double-break assembly is thus obtained and another one of the same construction is mounted alongside (at the left of fig. 3 and with the isolating switch projecting to the left), connection between the two top circuit-breaker units being effected by a tube which also encloses the coupling rod of the bell crank mechanisms.

The first 220-kV circuit-breaker of this type, with two breaks, has been in service at Rueyres on the Paris transmission line since 1932 with satisfactory results. The new 500-kV circuit-breaker contains about 44 gal. of oil. The total length of its four breaks appears to be 4 ft. 8¾ in., its energy dissipation about 500 kilojoules, and its total time of operation under 0.2 sec., the actual breaking-time being of the order of 0.05 sec.

* From a paper by L. Saudicœur, Head of the Research Department of the Ateliers de Constructions Electriques de Delle, *Revue Générale de l'Electricité*, Vol. 35, p. 815.

Sphere-gap Calibration

The measurement of pressures up to a million volts

Two papers read at the I.E.E. last week describe methods of securing greater accuracy in e.h.v. measurements

TWO papers were presented on January 7th in London before the Meter and Instrument Section of the INSTITUTION OF ELECTRICAL ENGINEERS. In one of them Messrs. R. Davis and G. W. Bowdler describe how an independent set of calibrations for sphere-gaps was obtained at the National Physical Laboratory to aid in the formulation of impulse flash-over figures which might be generally acceptable.

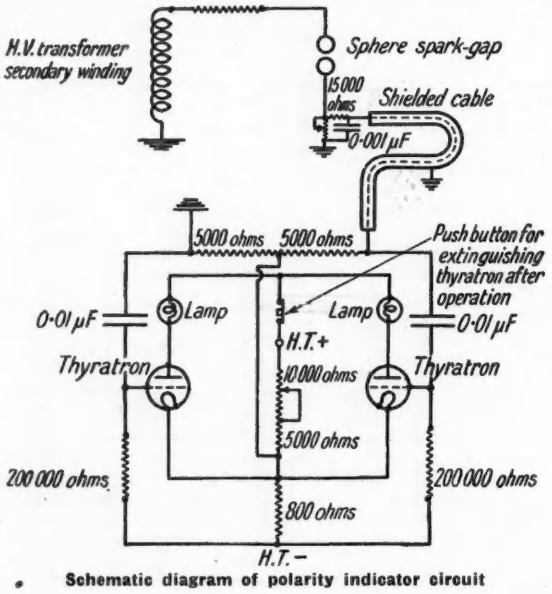
They also examine the technique of measuring such voltages (by means of a high-voltage cathode-ray oscillograph and resistance voltage divider) as applied to the determination of minimum impulse flash-over characteristics of gaps between spheres ranging in diameter from 125 to 1,000 mm.

The authors have found that the power frequency flash-over value is always less than the corresponding negative impulse figure (which other workers have hitherto thought to be equal) the difference being approximately 5 per cent. at a spacing equal to the radius of the spheres. Determination of polarity effects indicated differing gap behaviour which shows that performance under impulse voltages cannot be deduced from that at power frequencies.

Extremes of wave shape do not appear to affect the minimum impulse flash-over voltage, but spark gaps are not suitable for the measurement of voltage when breakdown occurs on the front of the wave.

In the second paper Messrs. F. S. Edwards and J. F. Smee (Metropolitan-Vickers Electrical Co., Ltd.) deal with the calibration of larger sphere gaps (up to 200 cm. diameter) for the measurement of greater voltages (up to one million, effective, at 50 cycles) than have hitherto been obtainable in this country. These calibrations are based on a method of voltage measurement which is believed to be unique. A crest voltmeter was employed, which necessitated precise determination of the capacitance of the associated air condenser, by means which are original and referred to in some detail in the paper.

From the results obtained it appears that in general the British Standards Institution figures (1929) are about 2 per cent. higher than the proposed American Institute of Electrical Engineers standards (1936) except for the largest size of spheres; while the calibrations in the present paper are about 2 per cent. lower than these standards, except in respect of the 12.5-cm. spheres.



Schematic diagram of polarity indicator circuit

Attention is directed to the polarity of the high-voltage electrode when breakdown occurs. For determining this a new type of indicator was employed which provided a permanent indication. It consists of two thermionic grid-controlled discharge devices ("thyratrons") so connected that when either of them receives a positive impulse this thyratron is energised, while the other is simultaneously "locked out" by the imposition of a high negative potential on its grid and a fall in its anode voltage. A negative impulse on one grid is accompanied by a positive impulse on the other, so that according to its sign an impulse affects either one or other of the thyratrons.

The instrument was mounted on the control desk and connected to the spark-gap by means of a shielded cable. The first quarter-cycle of the power-frequency current following the breakdown of the test gap provides the necessary tripping voltage.

The authors' polarity results follow the same general course as Meador's, but are quantitatively rather different. For 12.5-, 25-, 50-, and 75-cm. spheres (*a*) from zero spacing to a gap setting which is between a radius and a diameter there is a region where the polarity is rather uncertain, but with a tendency to become more negative as the spacing increases. (*b*) There follows a region where all the breakdowns occur on the negative half-cycle. (*c*) At a spacing between about 1.5 and 2 diameters the number of positive breakdowns rises very sharply indeed and for any larger spacings all the breakdowns are positive.

The sudden nature of the transition is very clearly shown when breakdown voltages are used as abscissae, but even at a spacing of 120 cm. it was not possible to obtain a very definite bias in the polarity of the breakdown voltage of the 100-cm. spheres, and this observation is confirmed up to a point by the N.P.L. which could not detect any polarity effect on 100-cm. spheres under impulsive voltages at a spacing equal to the radius, whereas the first draft of (A.I.E.E.) recommended sphere-gap standards (May 15th, 1935) showed that at this spacing the positive breakdown value should be 4 per cent. higher than the negative.

The consistency of the proportion of breakdowns of one sign to those of the other (except in the last case) is remarkable and confirms that at small spacings the polarity at breakdown is dependent solely on the relative conditions of the spheres. If the direction of breakdown is influenced not by more or less permanent irregularities on the spheres but by dust particles, &c., widely differing results will be obtained from day to day, or even from hour to hour, when the gap is relatively small. At larger spacings within the range where all the breakdowns occur on the negative half-cycle it is possible to reverse their polarity by placing a very small lump of plasticine on the high-voltage sphere. This also reduces the actual breakdown voltage enormously.

The sound of the breakdown was so distinctive that from it could be deduced with complete certainty (except at small spacings and in a few special cases) the polarity of the discharge, which was confirmed by the polarity indicator and by oscillographic records. Negative breakdowns gave a sharp crack like that of a whip, while positive breakdowns resulted in a buzzing noise.

Examination of Discharges

A few power-frequency spark discharges were examined with a rotating camera giving a resolution of 24 micro-seconds per millimetre of trace. With a spacing of 1 diameter breakdown began at the insulated sphere with the formation of a leader-stroke of the kind now associated with the lightning flash, starting from a negatively charged sphere, and it had the same characteristics as the leader-stroke of an impulse spark of negative sign. When this spark had developed across a part of the gap another leader started from the earthed sphere and the two sparks met near the middle of the gap, with the main spark following.

At a spacing of 3 diameters, on the other hand, the breakdown started at the insulated sphere with the formation of a leader-stroke of the kind which precedes a positive impulse sparkover. These results indicate that breakdown had occurred on the positive half-cycle at a spacing of 3 diameters, and on the negative half-cycle at a spacing of 1 diameter, but in the latter case it was accompanied by breakdown from the earthed sphere also. It is not generally appreciated that a sphere-gap calibration at small spacings may be very seriously in error (up to 80 per cent.) unless some means are adopted for irradiating the gap.

The authors carried out a short investigation at 50 cycles to determine to what extent the length of the gap and the site of the tests affected the error due to the absence of ultra-violet light, as these two variables do not appear to have been previously examined. In some tests arc lamps were used as the radiating source and in others radium capsules were inserted in the unearthed sphere. Strange results were obtained, but it is concluded that no errors will arise in the use of large spheres in the absence of any special source of ultra-violet light.

Meetings and Discussions

The characteristics and correct application of the turbo-electric drive in ships was among the matters considered by Major P. L. Jones in a lecture before the Institution of Mechanical Engineers last week. In a lecture to the Institution of Civil Engineers this week Sir George Lee, Pres. I.E.E., spoke in the capacity of Engineer-in-Chief of the G.P.O. of the handling methods adopted in the postal service. At the I.E.E. on December 6th the paper by three Reyrolle men on methods of protecting electrical equipment and systems was discussed at some length.

Ship Propulsion

RECENT developments in ship propulsion were the subject of the Thomas Lowe Gray Lecture before the INSTITUTION OF MECHANICAL ENGINEERS in London on January 7th, which was delivered by Major P. L. Jones, general manager of the Engineering Department of Swan, Hunter & Wigham Richardson, Ltd.

The lecturer pointed out that turbo-electric machinery had been installed in a considerable number of ships and had given very satisfactory results. It was sometimes argued that turbo-generators could be safely designed for higher steam conditions than would be advisable with geared turbines, owing to the elimination of the astern element and therefore reduced likelihood of trouble during manœuvring, &c., and that in consequence the maximum economy obtainable with both types was substantially the same, notwithstanding the fact that the electrical losses could hardly be less than 7-8 per cent., even in the largest installations, whereas the losses in the gearing were 2-3 per cent. only.

This, of course, was by no means generally agreed, and in any case, said Major Jones, geared turbines had proved themselves entirely satisfactory in operation, up to the highest temperatures and pressures now adopted in marine practice. Another advantage claimed for the electric drive was that full power was available for going astern. This was undoubtedly true, but the lecturer maintained that the great majority of geared turbine installations got along quite well with only about 60-70 per cent. of the ahead power available for going astern.

With electrical machinery it was necessary to carry expert electricians, and in consequence the cost of personnel was increased. A further point was that there were three links in the chain, *i.e.*, turbine, generator, and motor, against two only in the geared drive. This might not appear to be a very important point to land engineers, but owing to the paramount importance of reliability at sea, it was bound to be carefully considered by marine engineers. If turbo-electric propulsion was ever adopted to any extent it would be for reasons other than those which usually applied to the choice of machinery. It would not be because it was more economical in fuel and maintenance costs, cheaper, more reliable, less costly in personnel, lighter, or because it occupied less space; in all of these factors the lecturer's investigations had shown that it compared unfavourably with geared turbine machinery. There were special cases, however, where absence of noise was of more importance than the other considerations just mentioned, and in this respect turbo-electric machinery undoubtedly had the advantage.

Post Office Mechanisation

SOME of the more recent engineering developments in the Post Office were described by Sir George Lee, engineer-in-chief, at the INSTITUTION OF CIVIL ENGINEERS in London on January 12th.

Sir George first explained how operating costs were reduced by multiple use of circuits on the carrier frequency and co-axial cable systems. He referred to ultra-short wave radio telephony, an example of commercial communication within the optical range being the radio-telephone system across the North Channel between Scotland and Northern Ireland. There, by using two stations well above sea-level, a distance of approximately 36 miles was traversed, in which the path was entirely optical. As an example of a service working over a non-optical range, the radio-telephone service between England and Guernsey might be cited. It was attempted, in the first instance, to cover a range of 105 miles where the optical range was about 45 miles, but it was found that in late autumn and winter the signal-strength gradually decreased until the received energy was only about one-thousandth of that received during the summer. A change in the stations selected reduced the distance to 85 miles, and that gave a working range which was now 1.73 times the optical distance.

Power for Ships
Mechanised Postal Service
Safeguarding Systems

After describing the speaking clock which, during the first year of service, answered over 13,000,000 calls, Sir George Lee showed how the application of voice-frequency methods had reduced the cost of telegraph-line plant very considerably. For the next phase of telegraph development the switching apparatus to be employed was the same as that used in automatic telephony, and in the final system there would be approximately thirty switching points in different parts of the country working in connection with teleprinters.

On the Post Office tube railway during one week in January, 1937, 118,462 letter bags and 74,145 parcel bags were carried. The annual car-mileage during 1936 was 1,791,290. The mechanisation so far developed had mainly been in the direction of speeding up the transfer of mail between the points at which the various processes were performed. The trend of mechanisation was now, however, in the application to the actual sorting processes. An experiment was being carried out with a parcel-sorting machine in which the method of sorting was that the parcel was placed on the flap in front of which the sorter was seated, the flap connected with a shoot terminating immediately over a tray-conveyor; a push-button corresponding to the selection required was depressed, and that started the whole operation at a speed to permit sorting at the rate of thirty parcels per sorter per minute, as compared with the average speed of sorting into hoppers, which was approximately ten per sorter per minute. A further stage in mechanisation was the introduction into Great Britain of the "Transorma" letter-sorting machine. Each machine had five operator positions, and the nominal speed was such as to permit a sorting rate of fifty letters per operator per minute, so that an installation was capable of dealing with 15,000 letters per hour. The operator inserted the letter in a slot and keyed a code number according to the destination of the letter. During four days at Christmas, 1936, two machines handled approximately 1,300,000 letters.

Protective Methods

THE paper on safeguards against interruptions of supply (to which reference was made last week) was discussed at the INSTITUTION OF ELECTRICAL ENGINEERS in London on January 6th. In the absence of Mr. H. W. Clothier, who is starting on a trip to Australia, the paper was presented by Mr. B. H. Leeson, and it concluded with a demonstration illustrating part of the authors' recommendations in connection with the reduction of faults on overhead lines and apparatus associated with them, the specific object being to indicate the great importance of time lag on arc gaps used for protesting apparatus connected with overhead lines.

In opening the discussion, Mr. Johnstone Wright said that the authors' switchgear lay-outs were novel and attractive in many ways. They made provision for the inspection of all the component parts, including the bus-bars themselves, a most unusual feature in oil type switchgear. To give this facility it had been necessary to introduce isolators into the bus-bars and to that extent, presumably, the bus-bars were weakened. Therefore, bus-bar protection seemed to be more necessary in the proposed lay-out than in the normal lay-out. The authors' arrangement was not cheap and the cost of switchgear was already becoming a serious factor in supply economics. Consequently, everybody was looking for something which would cheapen switchgear and, at the same time, maintain reliability. However, it was difficult to do these two things at the same time.

He was not altogether in agreement with the authors on the question of ultimate safeguards. Protective gear failed at times and he did not like the suggestion that money should be saved on ultimate protection and spent instead on protective gear. His experience showed that this was inadvisable. There seemed to be an inferiority complex in this country so far as protective gear was concerned, but on the grid system last year the percentage of correct operation of protective gear was 86 per cent.

He firmly believed that in time, except on major bus-bars, protection of bus-bars would become standard practice. Nevertheless, before it was adopted extensively they wanted to be sure they were not introducing a hazard greater than the one they were trying to provide against. The authors' alternative to the Petersen coil was not a real successor. Moreover, the authors admitted complication as compared with the Petersen coil, and that was a great drawback.

Mr. T. W. Ross said that the only relay the authors had attempted to describe was a directional type designed on a principle which was not new and he believed it to be entirely

unsuitable as a directional relay. In his view a directional relay must be designed as a true wattmeter to withstand the very large overload conditions met with in practice. His own company had designed and manufactured and had had in successful operation; bus-zone protection apparatus since 1932. He could not see how the authors' alternative system was an improvement on the Petersen coil.

Mr. H. Trencham remarked that the paper served as a useful declaration of faith as to essentials and should have the effect of guiding thought. A sufficient number of automatic oscillographs on power systems would show what had happened much more accurately than dependence on log sheets and the few instrument readings which were generally available, after a certain amount of trouble. British switchgear was the best in the world, but there was no reason why steps which would undoubtedly make it better should be neglected. High speed operation was the right way to deal with faults, but, although instantaneous reclosure might be applicable to overhead line work from 33 kV to 132 kV, that might not necessarily be the case on cable systems.

Dr. W. Wilson recalled with satisfaction that many points of detail to which he had drawn attention in the discussion on Mr. H. W. Clothier's 1932 paper seemed to have been adopted in the present paper although, he added, the authors seemed a little nervous about one or two of their schemes judging by the use they made of relays to save the situation. There would be no need for that nervousness, however, if a biased scheme were employed. He was glad the authors had drawn attention to the weakness of the "Megger" test, because the range of articles covered by a specification had all sorts of insulation resistances and to fix one standard reading for the whole of them was absurd. The percentage of correct operation of protective gear was calculated in a very unfair way.

Mr. L. Gosland, referring to bus-bar zone protection, said there was great scope for a series of short-circuit tests in order to arrive at accurate methods for calculation. Would complete protection of a bus-bar zone make the occurrence of consequential faults so remote that the necessity for guarding against them would not arise? Why had the authors, after designing a breaker which used the minimum of oil for operation and breaking the arc, then proceed to increase the total volume used by incorporating a new oil operating mechanism?

Dr. C. C. Garrard said the paper contained a considerable number of generalities which would receive general assent. All engineering consisted of reconciling different points of view. Referring to "the remarkable type of switchgear" illustrated in the paper, Dr. Garrard said it appeared to be a reversion to the cubicle type, but it seemed to him going too far in the pursuit of accessibility to pull out the bus-bars when it was desired to see whether they were functioning all right. A properly constructed bus-bar required little or no maintenance. While alarm relays set lower than the master relays had been applied to cables, he doubted whether this method was possible with bus-bar protection. The operating relays should be set as low as possible, stability being attained by other means. The system of arc suppression by voltage injection was very ingenious and would have been justified during the life of the patents covering the Petersen coil, but as these patents had now expired it seemed to him that the Petersen coil was much to be preferred owing to its greater simplicity. Experience was available which, if confirmed, showed that the Petersen coil, applied to cable systems, added considerably to the reliability of supply. Personally, he was against the use of automatic reclosing circuit-breakers in major power stations.

Mr. W. A. Coates said the authors' remarks on voltage co-ordination must be interpreted with some caution, although he was not quarrelling with what they had actually said. In overhead line work if the switchgear or transformers were designed to have impulse voltage characteristics co-ordinated with the clean insulator characteristics of the line, then the increased cost might be completely prohibitive. It was essential on overhead lines to have some form of high-speed gap or lightning arrestor and to correlate the insulation of the switchgear and transformers with those gaps. He quarrelled with the finding of Sporn and Prince, quoted in the paper, who had stated that successful reclosures could be obtained without loss of synchronism if the total time between the beginning of a fault and the reclosing of the circuit was not more than 20 cycles; and without risk of restriking the fault arc if the time during which the tie line was completely de-energised was not less than 12 seconds. For some years past the Victoria Falls Power Co. had operated two of its 88-kV lines in parallel. If a fault occurred on either line, No. 1 circuit-breaker came out. It was then reclosed and in reclosing it automatically tripped No. 2. The original 2 seconds time interval had been modified and much greater success was being obtained with a time interval of one second.

Mr. P. Matthews referred to the stability of bus-zone protection, and added that it was clearly better to design properly than to use a second line of defence against improper design. There was to-day no difficulty in designing current transformers to give the requisite sensitivity and stability, even with the use of instantaneous type relays. The opposed voltage scheme for feeder protection which the authors referred to appeared to have rather more components than another long-established opposed voltage scheme, and, moreover, no reference was made to feeder protection schemes based on the circulating current principle, which had been in successful operation for many years.

Dr. R. Davies remarked that oil immersion would avoid the necessity for taking things to pieces, as was suggested in the paper. It was not sufficient to design metal-clad equipment and say it was good; it was only good if it fitted in with the layout and every circuit-breaker should be backed up by oscillograph tests.

Mr. C. J. O. Garrard said that although the great advantage of some of the new designs of switchgear was compactness, was this one of the prime virtues? It was the custom to lavish space upon boilers and generating plant and to put the switchgear away in some small corner!

Mr. Leyburn, replying to some of the points raised in the discussion, said he believed that protective gear failures as a rule were due to instability and not to failure to trip. Bus-bar protection must be dealt with primarily from the point of view of preventing instability; actual failure to trip was extremely rare. The method of giving an alarm first and then leaving the attendant to disconnect the faulty bus-bar by hand had been evolved primarily because of the fear in the minds of operating engineers that instability might occur. It was only for this reason that a rather cumbersome scheme had been evolved, but, eventually, he believed that bus-bar protective schemes would be automatic. Mr. Leeson also briefly replied to criticisms of lack of detail in the paper, stating that the object was to bring forward the main issues with which the industry was faced, *viz.*, how far protection should be adopted and how far it should not.

Powdered Duff Fuel

THE long paper on the combustion of anthracite duff in pulverised form, by Mr. J. Mayer, which was read before the INSTITUTE OF FUEL in London on January 13th, is largely concerned with the steam boiler installations of the Amalgamated Anthracite Colliery Co. at Cefn Coed, and of the Swansea Corporation's Tir John electric power station. The leading particulars of the plants are summarised and methods of firing outlined, while official tests are referred to and general operating experiences are detailed at some length.

The author claims that sufficient experience has been obtained to venture the following general statement covering the essential features of the problem:—

The variation between the combustion properties of anthracite duff from different areas in the field is sufficiently marked to make worth while special arrangements for marshalling, grading and bunkering coal supplies. In view of the importance of primary aeration on the combustion process, the central system is to be preferred to the unit system; but it is at a disadvantage in that special steps have to be taken to correct the loss of intimacy of primary air mixture after the ground fuel has been bunkered. The type of furnace should preferably include a hot zone in the burner region with complete water cooling elsewhere, rather than a partial degree of cooling all over the furnace. Probable optimum rating of combustion chamber 18,000 B.th.u. per cub. ft. per hr. The use of air at high temperature does not appear to be of primary importance. The selection of ball mills is confirmed.

What further progress will be made in the utilisation of this type of coal for steam generation purposes is difficult to forecast. The incentive to its adoption was undoubtedly the price level ruling at the time. In 1931, duff was valued at the pithead at about 4s. 6d. per ton; to-day the figure is of the order of 10s. to 12s. 6d. per ton, but even at the higher figure it still remains an attractively priced fuel. Another factor which has to be borne in mind is that the production of Billy duff (the smallest sizes produced in the winning of the coal) bears a definite relation to colliery output, so that the availability of extended supplies is dependent on the state of trade, which in the anthracite industry is largely its export trade.

The consumption of extracted dust will probably be confined to its utilisation near the source of production, since the transport of the dust offers many problems. For an installation of this nature, a mechanical or air separating unit, together with feeders, burners and primary air fan, will provide an adequate firing unit. Whatever further progress may be made, the author claims that a standard of performance has been achieved which compares favourably with the general progress of the last decade in the efficient utilisation of fuels generally for large-scale steam raising.

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

Motor Starting Regulations

We were very glad to note that Mr. R. W. Towers has raised the above question and also to observe your editorial reference to it in your issue of December 24th, as this is a matter which is a constant source of concern to motor manufacturers.

We are frequently compelled to supply slip-ring motors for duties where, but for the supply authorities' regulations, squirrel-cage motors would be far more suitable and there are some areas in which it appears technically impossible to supply motors for certain duties and at the same time comply with the requirements laid down by the supply authorities.

With regard to some of the single-phase supplies in London, whilst we agree with Messrs. Brook Motors that it is possible to design machines to comply with the regulations, surely it is a very strange state of affairs which makes this necessary? The authorities' regulations should be framed to encourage the widest and most efficient use of electricity, but the effect of the illogical confusion which exists at present is to hamper the development of electric power and, in many instances, to prevent the most suitable and most efficient motors being used.

We hope that the ventilation of the subject in your columns will do something towards the removal of some of the more flagrant anomalies. BULL MOTORS

(Branch of E. R. and F. Turner, Ltd.).

S. F. STEWARD,

Ipswich, *January 4th.* *Sales Manager.*

Domestic Electric Heating

Mr. H. H. Berry, in his contribution entitled "The Domestic Hearth," published in the ELECTRICAL REVIEW dated November 26th, emphasises the importance of paying due consideration to the psychological effect of coal fires in the development of the domestic electric heating load. The sales of electric fires in general, and imitation coal electric fires in particular, during the past few years, leaves no question as to the popularity of this type of fire, which affords all the advantages of a coal fire in the way of psychological effect minus the accompanying disadvantages of its contemporary.

There is no doubt that the approach to increased domestic heating load lies *via* the imitation coal fire, but from the heating viewpoint it should be considered as a temporary expedient. It is self-evident that the position of coal fires in houses is governed by the only possible location of chimney breasts, flues, &c., and not by ideal heating considerations. Much the same applies to all other forms of heating requiring flues. The results in the way of uniform temperature conditions draughts, overheating, &c., are only too widely known, especially in severe weather. Temperature differences in different parts of even small rooms may be as much as 15/20 deg. F., and this state of affairs is not materially improved by merely replacing the coal fire by an electric one.

The use of electricity enables unprecedented departures to be made in improving the general efficiency of heating if correctly applied, by the installation of secondary heating by means of tubular heaters, convectors and panels in places where the heat is really required. Such an arrangement will, in the long run, provide a far more efficacious selling point for electric heating than the mere imitation of a coal fire and placing the substitute in the same position.

It would appear a far better proposition to encourage the average consumer to employ small and relatively inexpensive imitation coal fires and spend the balance in providing a reasonable amount of supplementary heating, than to recommend the purchase of large radiators of higher loading. From the running cost viewpoint there is little doubt that where electric heating is alone employed, the former arrangement would prove the cheaper. B.Th.U.

January 10th.

Engineering Education

Your report of the discussion upon Engineering Education at the Institution was very interesting, especially to people like myself, whose daily task involves the running of modern electrical and mechanical manufacturing works.

For more than forty years it has appeared to me strange that those in the higher positions in industrial and commercial engineering rarely give their views upon the type of man and training required. Educational specialists are, therefore, left to guess or dictate the requirements, which may not produce the best results, and many of the contributors to the discussion were such specialists.

During the whole of my experience as works and general manager of firms in London and the Provinces no questionnaire has ever reached me, nor has information been solicited by other means. Educationalists have not yet assimilated the most elementary rule in business, *i.e.*, the attitude of the supplier towards the buyer, which affects the whole thing fundamentally, and the suggested Education Sections should not be allowed to get entirely into the hands of the educationalists.

The discussion brought forth unconventional ideas, varying from keeping people away from responsibility until twenty-four years of age to questioning whether education should be considered as a means of earning a living, and it appeared that if educationalists did not fill the gap, industrialists would do their own training. This has begun already, although I do not believe industrialists wanted to do it. In some quarters it even seems to be thought an advantage to prevent a student getting out of a college until late in life, although it is not clear what he does in the interim pending the arrival of his old age pension. Others appear to think that nothing theoretical can be assimilated outside a college.

Some educationalists still attach the utmost importance to memory and would prevent reference books being used at examinations. How far would industry get without the pocket books and tables in our drawing and designing offices?

The Institution might well be expected to act as a liaison between educationalists and industrialists, but recently it appears to have been influenced mainly by the former, who evidently consider it far more important, at least as regards a degree, that a candidate be in possession of a foreign language than that he should be able to use hand and machine tools. Nobody can keep pace with the flood of technical literature even in his own language and to be able to use a typewriter is a far more useful accomplishment.

Engineering education, as I see it, is the training of the hand, the eye and the brain. This should proceed in balanced unison when young, over-training in one department being at the expense of the other. The final result should leave the student able to extend either side later according to inclination. This would mean the cutting out of a lot of advanced theoretical work in the majority of cases, but there would be none of the helpless feeling when slung on the labour market, as any such combination would enable him to hold his own reasonably from the start. Practical training must, however, be decided by the industrialist. A degree that was granted for such combined skill would carry weight with employers.

This is not an attack on the higher technically trained, who will always be required in teaching and research; rather is it a plea for better balance between genuine skill and book learning in those entering industry. The main lead will have to come from the Institution. CHARLES BAXTER.

Walton-on-Thames, *January 11th.*

Charges for Cooker Wiring

I read in your issue of December 17th the interesting article on the popularity of electric cookers. One reason why they are not more widely used is no doubt the ridiculous charge made by some supply authorities for wiring the point. A friend of mine recently put in a small cooker costing about £4 and was charged about £2 for the 1½ hours' work and material for the job (distance from cooker to point 11 feet).

I know of several people turning down both heaters and cookers owing to this charge. It certainly is a peculiar way to foster the use of electricity.

I am, of course, well aware of the fact that some supply companies wire up the cooker on which they receive the largest discount free, but most users prefer to choose their own. ARTHUR O. COUSINS.

Blandford, Dorset, *January 6th.*

Street Lighting at Plymouth

On page 941 of the December 31st issue of the ELECTRICAL REVIEW a paragraph appears with reference to street lighting in the City of Plymouth. It is stated that the Electricity Committee has decided to improve the lighting at Old Town Street and Mutley Plain, whereas on Mutley Plain "Osira" lighting was recently fixed and it is not intended to alter this installation in any way.

The alterations decided upon by the Electricity Committee were the improvement of the existing street lighting in Tavistock Road, Plymouth, from Old Street along Tavistock Road to the City boundary at Mannamead with the exception of Mutley Plain. H. MIDGLEY.

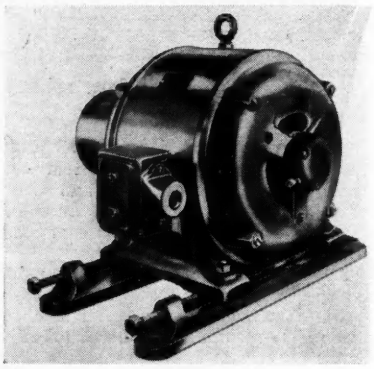
Plymouth, *January 1st.* *City Electrical Engineer.*

Motors with Special Characteristics

THE new "E" range of electric motors introduced by Crompton Parkinson, Ltd., Bush House, W.C.2, is intended to provide in standard machines exceptional characteristics previously obtainable only in special designs. In each of the four types design, materials and electrical relations have been chosen with regard to one particular service, but where required the features of the various "Range E" machines can be combined, to give, with few exceptions, the characteristics of a squirrel-cage construction.

The rotor comprises a core of stampings in which a metallic cage with a set of ventilating vanes is cast solid. Depending upon the particular performance features to be emphasised, certain non-ferrous elements are injected into the molten metal of the cage before casting to provide the optimum electrical properties.

First in the series is the "S-S" (super-silent) model, which is designed to minimise electrical noise by securing a practically pure sinusoidal waveform and mechanical noise by the incorporation of a self-lubricating bronze journal (which also permits mounting at non-standard angles. Any residual noises are eliminated by the application of appropriate acoustic principles that take into account the properties of the site. These principles are based upon the inaudibility of sounds that are lower on the acoustic scale than the normal background noise of the situation in which the motor operates.



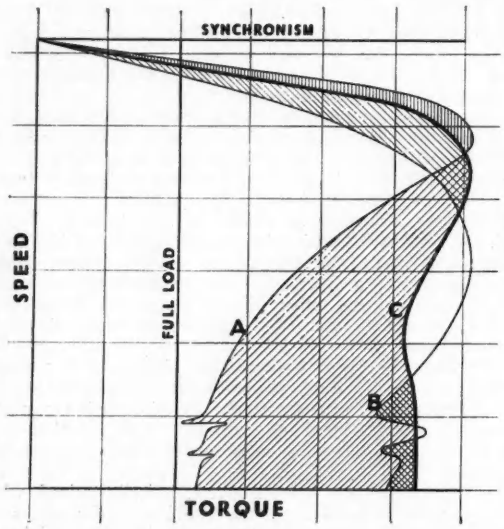
The new Crompton Parkinson "S-S" motor

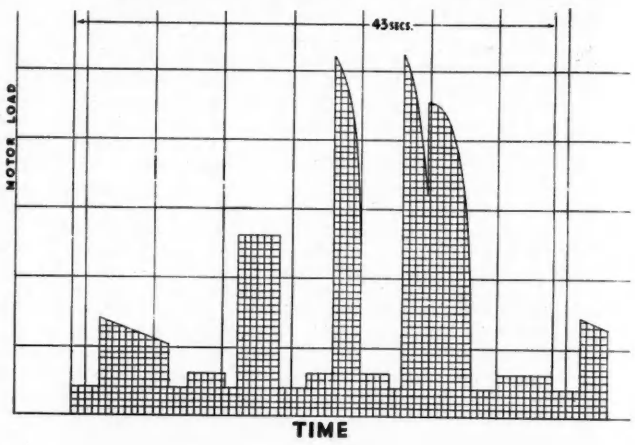
For the "Tork" motor it is claimed that any given starting torque is developed with only two-thirds of the current taken by an ordinary squirrel-cage motor of similar capacity, that the running efficiency is higher due to the smaller speed variation between no-load and full load, and that acceleration is exceptionally smooth.

Where continuous, or nearly continuous, operation is required, the "Lowloss" motor is put forward. The cost of losses at 100 per cent. load factor for a 5-h.p. motor, for example, is claimed to be only two-thirds of a good all-round induction motor. This is achieved by a number of small refinements, mechanical and electrical, *e.g.*, eddy-current losses are reduced by the use of specially thin laminations for the steel stampings of a grade blended to secure minimum hysteresis losses; in connection with this, magnetic densities have at the same time been lowered, giving further increase in efficiency.

Duties that entail frequent reversal on full load, up to as much as forty times a minute, provide a field for the "R.V.R." motor, which has been designed in particular for the machine tool industry. An ordinary double-pole reversing switch only is needed for operation, and it is claimed that even at the instant of reversal from full speed in the other direction the current peaks are lower than those with a normal machine started against no-load with a direct starter, thus minimising strain on control gear as well as heat losses. Reversing torque usually exceeds twice the full-load figure. Acceleration is comparable in smoothness with that obtained with the "Tork" motor. No combustible or semi-combustible material is used for insulation.

Left: Comparative torques at starting of squirrel-cage motor (A), squirrel-cage high-torque machine (B) and "Range E 'Tork'" motor (C). Right: Load characteristic of typical 2-h.p. R.V.R. motor operating a change-speed reversing capstan lathe





Working Costs of Heavy-oil Engines

AT its meeting in London on January 13th the DIESEL ENGINE USERS' ASSOCIATION considered its annual report on the working costs of heavy-oil engines.

The 1936-37 statistics represent sixty-six stations, and among the newcomers are five of the B.B.C. stations, which have relatively high annual load factors. The average fuel consumption of forty stations was 0.647 lb. per kWh generated, with an average load factor of 67.3 per cent. This was 2 per cent. below the standard consumption curve, as compared with 3 per cent. below during the previous year. The average consumption of lubricating oil was 2,275 rated b.h.p.-hours per gallon; thirty-one stations produced more than 2,380 b.h.p.-hours per gallon.

At home forty-three stations generated 68,030,989 kWh and twenty-three overseas stations produced 117,690,777 kWh in the year; 203 engines at home totalled 56,686 kW (installed) and 104 engines overseas totalled 46,644 kW. The maximum load carried was 44,298 kW at home and 34,145 kW overseas, respectively 78.2 and 73 per cent. of plant installed.

The running plant load factor was 64.9 per cent. at home and 68.8 overseas. The price paid for fuel oil was 80s. 9d. per ton at home and 99s. 10d. overseas. Lubricating oil cost 2s. 4d. per gal. at home and 3s. 4d. overseas. The lowest total engine cost at home for the year was 0.395d. per kWh generated (B.B.C., Droitwich) and 0.23d. overseas (Trinidad Leaseholds, Ltd.).

The largest home station was that of the States of Guernsey Electricity Dept., with ten engines of 4,272 kW which produced 5,321,642 kWh; followed by nine engines of 6,400 kW which generated 5,076,120 kWh for the Charing Cross Electricity Supply Co., Ltd. Overseas, ten engines of 15,300 kW produced 48,089,860 kWh for the Western N.S.W. Electric Power Pty., Ltd. (Broken Hill), and ten engines of 3,937 kW generated 9,859,139 kWh for the Delhi Electric Supply & Traction Co., Ltd.

Twenty-five stations have been running for periods of from ten to fifteen years at total average costs of between 0.388d. (Crompton Parkinson, Ltd., fifteen years) and 0.902d. per kWh produced.

In fourteen waterworks stations forty-nine engines of 9,301 b.h.p. produced 14,223,848 water-h.p.-hours at total engine costs of between 0.466d. and 0.823d. per w.-h.p.-h.

New Apparatus and Devices

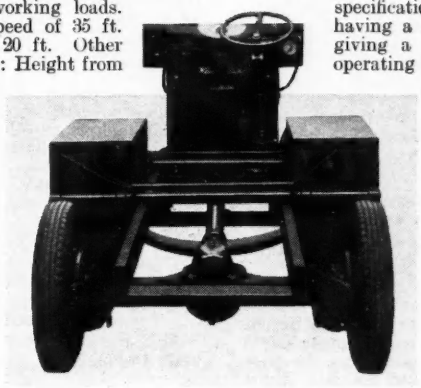
for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Electric Hoists

Embodying a machine-tool motor unit, the electric pulley block produced by PICKERINGS, LTD., Globe Electric Works, Stockton-on-Tees, is made for two working loads. The half-ton model has a hoisting speed of 35 ft. per min., and the one-ton model of 20 ft. Other salient particulars of the two types are: Height from hook to point, suspension, 2 ft. 3 in. and 2 ft. 9 in.; overall length, 2 ft. 2 in. and 2 ft. 6 in.; net weight, 1¾ and 2 cwt. In each case the maximum height of lift is 30 ft.

The following features are common to both: Ground-steel winding barrel, cast-steel end frames, oil-hardened nickel-steel gears in totally enclosed gear box, shafts of high-carbon steel, ball or roller bearings throughout. The equipment also includes a drum controller, mechanical brake, limit switch, rope guard and large inspection covers. Either push- or geared-travel trolley and either current collectors or flexible coils can be supplied.

The motors can be wound for voltages up to 550 for use on two- or three-phase circuits at 50 cycles. Designs are in hand for push-button operated and two-speed blocks of generally similar construction.



The Wilson "Bulldog" chassis

Artificial Daylight Units

Although the quality of the light produced was the primary consideration in the design of the new Marley artificial daylight units and reflectors (it is claimed to be within 4 per cent. of pale sunlight), it is claimed that an economy of 40 per cent. in electricity used can be effected by their use.

Unlike most other similar units the fittings require no filters or blue bulbs. The colour correction is obtained solely by means of a specially designed glass reflector which has a thin coating of blue glass blown on to two layers of plain crystal glass and is silvered and coppered at the back.

Models are made for every purpose—drawing offices, shops, printing works, dye works, dental mechanics' workshops, &c. In fact, the quality of the illumination is said to render the fittings eminently suitable for all general purposes, the cold, bluish tinge usually associated with this type of unit being completely absent. For interior use the reflector is incorporated in the canopy and it is simple to convert existing fittings of any make by the addition of one of the units intended specially for that purpose. The manufacturers, the MARLEY MANUFACTURING CO., 96, Charlotte Street, London, W.1, inform us that they give a five-years' guarantee with all units.

"Marley" artificial daylight reflectors for industrial (left) and shop window use

A New Electric Vehicle Chassis

The new "Bulldog" electric vehicle of PARTRIDGE, WILSON & CO., LTD., Evington Valley Road, Leicester, embodies several special features, amongst which is the new hand-brake design; this is set parallel to the steering column and does not cause any obstruction to the driver. New electric tyre equipment is also incorporated.

"Exide Ironclad" lead acid batteries are fitted as standard to these chassis. It is claimed that, in practice, their life may be estimated at 4½ years. The 30 cells have been standardised, and these are hung pannier fashion in two sections from tubular members on either side of the chassis frame. Thus they are both very accessible and easily detachable. The maximum commercial permissible range of an electric vehicle is an arbitrary figure, but is considered by many users to lie between 33 and 36 miles. The range per charge may be increased considerably above this point by the use of larger-capacity cells. The optimum point for the lowest cost per ton mile has been found in practice to be 35 miles in provincial towns and 30 miles with the more arduous traffic conditions of London.

Two battery capacities are provided for in the following specifications: (*a*) With Model A.I.W., 30 cells T.L.9, having a capacity of 192 Ah at the five-hour rate, giving a range, with eight stops per mile when operating in London, of 30 miles. (*b*) With Model B.I.W., 30 cells T.L.11, having a capacity of 240 Ah at the five-hour rate, giving a range, with eight stops per mile when operating in London, of 37 miles.

The new design of controller incorporated in the "Bulldog" chassis is based on the "Wilson" patent automatic controller, which is designed to prevent over-driving. The principle, in brief, is that of hydraulic checking, which obviates the possibility of the controller mechanism being operated other than at a preselected rate. Four speeds are provided by way of a massively constructed foot pedal, which controls the operation of the four contactors, speed of operation being governed by the hydraulic checking unit. The forward and reverse contactors are manually operated by an easily accessible hand lever, which also provides an off or isolating position.

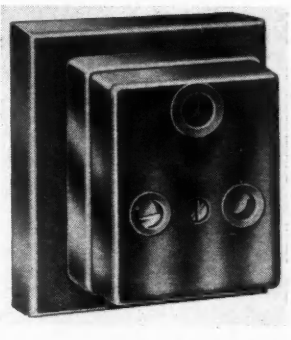
The contactor units are of a new design and are so constructed that the assembly or dismantling of the contactor of this type may be done without the use of tools. Each process can be achieved in a matter of 5 seconds. The mechanism is spring-loaded, and any wear that may occur is immediately taken up. The whole controller is mounted in the front "U" frame and may be inspected without obstruction.

The motor is of the high-efficiency ventilated traction type, specially manufactured by the General Electric Co., Ltd., having a horse-power of 4¼ (one-hour rating). Central mounting is employed in an accessible position, the brush gear and commutator being conveniently placed for the customary periodical inspection through a removable cover, which is spring-operated.

Shielded Socket Outlets

A range of shielded sockets specially designed to stand up to heavy use, such as obtains in working-class kitchens with kettle control, has been introduced by J. A. CRABTREE & CO., LTD., Lincoln Works, Walsall, as the result of experience gained in actual conditions of this kind.

It is necessary that this type of socket should have strong arc-quenching screens, immune from tracking and carbonisation, and insertion of the earthing pin should not expose the "live" sockets. Rapid action on withdrawal of the plug is essential.



The Crabtree shielded socket

The rustproof mechanism is totally enclosed and is constructed without the use of parts screwed together. The arc-quenching screens are carried on steel arms moving in recesses in the moulded cover, each independently operated by its own steel compression ring. A tough ceramic material is used for the screens to give freedom from tracking and carbonisation, its insulating properties being equal to those of porcelain. Arc suppression is achieved by the snap action of these screens.

Compliance with the I.E.E. regulations and B.S.S. 546 is assured, "overhang" being impossible.

Electric Dry Shaving

It is estimated that there are over a million electric dry shavers in use in America, but in this country the idea of dry shaving still represents a new and attractive development. The latest device of this type to be introduced into England is the "Clipshave," which is being sold by OREL-MICRO ELECTRIC, LTD., 39-41, Berners Street, London, W.1.

The "Clipshave," a sample of which we have examined, works on a different principle from the razor, being in effect a small version of the electric hair clipper. There is no blade, as such, only a shuttle type cutter operating at 2,000 vibrations per minute. With this type of shaver it may not be possible to get such a close shave as with a really sharp razor, but it does seem quite impossible to cut oneself, the lack of soap and water is a great time saver, and there is no soreness however tender the skin; on the contrary the effect is invigorating.

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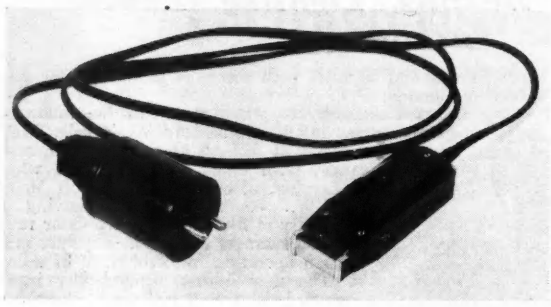
The technique of shaving, however, is different from that with a razor, and it takes several days to accustom oneself to it. With skin that has been shaved with a razor for many years the best results are not obtained until it has had time to soften.

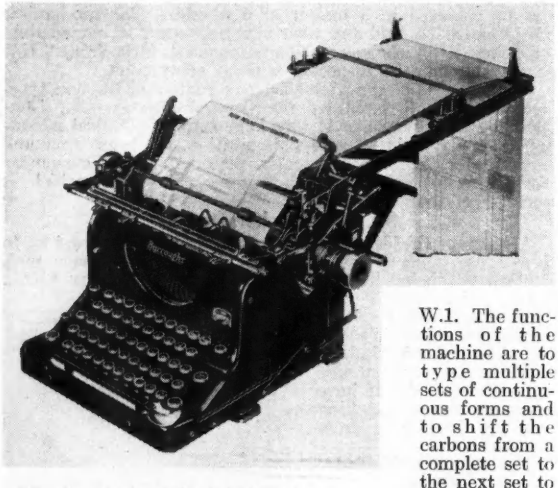


The electric "Clipshave": the resistance shown on the left enables it to be used on 200- to 250-V supplies

The shaver has a brown moulded casing and is supplied in a leather case. The clipping head of this new type of shaver, with its two-way outside cutting edges, permits shaving in both directions, and the V-shaped slots enable long or short, fine or coarse hair to be removed with equal ease. Because the hair is forced from the instrument and not into it the "Clipshave" is self-cleaning and clog-proof. It can be used for trimming moustaches and beards.

Automatic "Fanfold" Machine

An electric "Fanfold" machine which reduces carbon shifting to one simple motion has been introduced by BURROUGHS ADDING MACHINE, LTD., 136, Regent Street, London, W.1. The functions of the machine are to type multiple sets of continuous forms and to shift the carbons from a complete set to the next set to be written. The carbon shifting usually requires a number of movements, but the new machine reduces it to one simple operation.



The Burroughs "Fanfold" machine

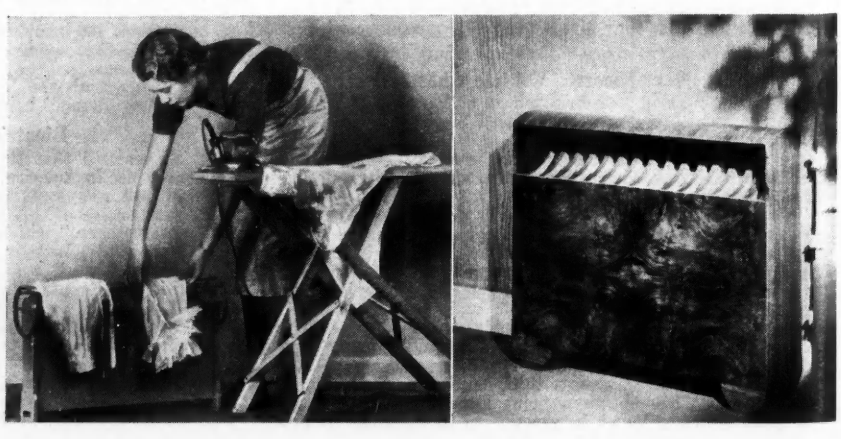
When the invoice or other form has been typed, the touch of a motor bar opens the carriage for the removal of the forms and automatically places the carbons in the next set of forms. The new machine has electrified carriage return, capital shift and space up.

Decorative Convectors

UNITY HEATING, LTD., Vincent House, Vincent Square, London, S.W.1, has recently added three neat new ranges of "Floodwarmth" convectors available in pleasing finishes.

All three types are approximately the same size, namely, 2 ft. 3 in. wide by 2 ft. high by 6 in. deep, and contain the same type of elements as those in the company's previous models. A visual impression of warmth is given by a concealed orange-sprayed lamp.

Alternative tops, curved or scroll, are available in wooden models, which, in limed oak, natural oak, dark oak and walnut, harmonise with any period or style of furniture. With a loading of 1 kW there is no danger of the seven-ply cases warping. Though generally very similar in appearance, the plain sheet steel counterpart has in its graceful combination of straight lines and curves a rather more modernistic touch with the minimum of "dust-traps." There are three variations of this, the scroll top, pillar and cabinet types. Standard colours are sepia, powder blue, powder green and "broken white," special finishes being supplied at a slight extra cost.



The "Unity" warming horse and a new convector

The third, and *de luxe* model, is constructed of anodised cast aluminium with a removable front panel of "Vitrolite," which can be had either in black sandblast, green, fluted sandblast, blue or agate. All the metal models are obtainable with either 1, 1½- or 2-kW loadings, and can be supplied with thermostatic control.

Another new development, the "Warming Horse," is particularly suitable for flats and small households where light washing is done at home. Measuring only 2 ft. wide by 1 ft. 3 in. high by 3 in. deep, this compact 1-kW convector is supplied with a detachable frame for drying silks, stockings, babies' clothes, &c. A portable hexagonal electric airer, incorporating a 120-W tubular element with substantial fin-shaped guards, is also available for airing cupboards or as a foot-warmer.

Though intended primarily for marine use, the 1-kW Unity cabin convector is finding considerable applications in homes where space is a consideration, its overall depth being only 3½ in.

A Small Domestic Refrigerator

At the banquet which followed the INTERNATIONAL REFRIGERATOR CO.'s recent annual convention the new model LA-34 B.T.H. 3-4 cu. ft. refrigerator made its début.

The LA-34 B.T.H. refrigerator

Outside, this new cabinet has bold, clean lines, rounded edges, and the minimum of crevices to collect dirt. The internal construction follows the well-known B.T.H. principles. The hermetically sealed refrigerating unit is mounted in the base and the mechanism has a five years' replacement guarantee. The freezer is of stainless steel and the cabinet inner shell is seamless with vitreous enamel finish. The controls, which include an on/off and defrosting switch and a nine-point temperature regulator, are neatly grouped on a small panel mounted on the front of the freezer. The cabinet is of the same capacity as the smallest model marketed last year although the dimensions are slightly reduced. Some interesting details regarding the construction of the B.T.H. refrigerators were given by Mr. H. N. Sporborg, director and chief engineer of the B.T.H. Co., Ltd., Rugby, at the banquet. For the evaporator stainless steel and SO_2 refrigerant have been used, and in order to overcome difficulties in welding a special process had to be employed whereby "doses" of energy are supplied every 3/50 sec. for a period of 2/50 continuously. There must be no variation in this, and therefore, because ordinary switchgear is unsuitable, the "Thyratron" valve has been adapted to this purpose. Stringent tests are necessary when it is realised that the compressor pump does 200,000,000 revs. per annum, and 1,000,000,000 revs. under the guarantee. It appears that the rough treatment during transit has, in the past, caused trouble and tests include dropping on to a concrete floor.

Fair Trading Policy

The work of the Council during 1937

WE are now in a position to give later information regarding the work of the Electrical Fair Trading Council than appeared on page 22 of our last issue.

During the year 1937 the Council held nine meetings at which a number of important matters of commercial interest to the trade generally were dealt with. Mr. W. Finlay (E.C.A. of Scotland) and Mr. V. Watlington (B.E.A.M.A.) were unanimously re-elected independent chairman and vice-chairman respectively, at a general meeting held early in the year and these gentlemen have since been re-elected for the third year in succession, so they will hold office during 1938.

The member-associations and their representatives are as follows:—

A.M.A., Messrs. E. S. New and F. C. Vine.

B.E.A.M.A., Messrs. R. Ball, T. W Heather and V. Watlington.

C.M.A., Col. Sir Thomas F. Purves and Messrs. H. D. Roberts and A. E. Tanner.

E.C.A. of Scotland, Messrs. J. Allan, W. Finlay and Alex. Lindsay.

E.L.F.A., Messrs. A. J. Burbidge, W. T. Dean and A. E. Iliffe.

E.L.M.A., Mr. C. W. Sully.

E.W.F., Messrs. A. Albrecht, A. G. Beaver and A. B. Wildsmith

N.E.C.T.A., Ltd., Messrs. T. E. Alger, L. C. Penwill and W. H. Walton.

Secretary, Mr. Felix A. Rogers (Offices: Kern House, Kingsway, London, W.C.2).

Last year it was reported that the Fair Trading Policy had been issued with an explanatory memorandum recommending all concerned to adopt voluntarily the trading principles enunciated therein. Considerable progress has since been made in securing support for these general principles and we understand that there is a growing recognition of the value of an agreed code which would define the functions of the various distributing channels through which electrical products reach the actual user.

Where any differences of opinion still remain, however, with regard to appropriate discounts, it is felt that any conflicting views can be reconciled, as the Policy gives adequate recognition to the principle of quantity terms for such buyers as are in a position to purchase in large quantities.

The usefulness of the policy itself has been further instanced by discussions which led to the alteration in the basic trade discounts applying to certain industrial lighting fittings. The Electric Light Fittings Association (Industrial and Commercial Section), in conjunction with other important manufacturers, were desirous of adopting a standard basic trade discount on industrial fittings, and they approached the Council which had endorsed the previous scale of discounts. This approach enabled a full discussion to be held between the various interested sections of the industry which are represented on the Fair Trading Council, and as a result of this discussion an arrangement equitable to all parties was concluded. The agreed alterations to discounts thereby received friendly support, particularly of the wholesale and retail sections of the trade. Appropriate correction slips drawing attention to the alteration to Schedule 3 of the Policy were duly circulated to all firms who had received copies of the original document, and the change was announced in the ELECTRICAL REVIEW.

Another event of the year was the holding of a joint meeting with representatives of the Royal Institute of British Architects to consider the Policy in relation to the practice in connection with prime cost items. The exchange of views which took place showed that the R.I.B.A. representatives were very much in sympathy with the aims and objects of the Policy. With regard to the specific practice referred to, they explained that the existing R.I.B.A. Standard Form of Single Contract had been in use for so many years, that it had become the accepted standard in all the various trades with which architects were in daily contact. For this reason it did not appear possible at present to alter the existing procedure, but the R.I.B.A. representatives appreciated the problem of the electrical industry.

Representatives of the British Synchronous Clock Conference were also met during the period, on matters appertaining to the distribution of electric clocks. This discussion showed that the Conference had already established its business on fair trading principles and that the conditions under which its members were operating had the support of all sections of the trade.

Another point to receive consideration was the incursion into the electrical industry of wholesalers in other trades, and the Council recommends to manufacturers and suppliers of electrical materials that in the interests of the industry as a whole the granting of "wholesale terms" on electrical goods should be restricted to bona-fide wholesalers only, who are known to operate properly established electrical departments in accordance with the appropriate definition in the Fair Trading Policy.

It is not surprising that during the year the Council received complaints that certain private individuals, firms, clubs, societies, and similar bodies, were attempting to obtain discounts to which they were not entitled. As our readers know, it is a fundamental principle of the Fair Trading Policy that discounts are allowed only to those genuinely engaged in the electrical industry who, by devoting their time and resources to the distribution and installation of electrical products, render services which justify the granting of such discounts.

Municipal Trading. By J. R. W. Murland, B.Sc., A.C.G.I.

A possible solution

THE recent report, presented by the borough electrical engineer of Southend, has focused attention on the whole question of municipal trading, which is of the greatest importance to the electrical industry. It is essential to arrive at some reasonable, and acceptable, solution to the problem with the least possible delay. If the matter is allowed to remain in its present unsatisfactory state the industry will be divided within itself, a condition all the more serious because it concerns those sections which are in direct contact with the public.

We have been told often enough that the electrical industry is only on the threshold of its ultimate development. This truth is worth repeating, to draw attention to the undoubted fact that, without complete co-operation between the various interests which make up the industry, progress towards this ultimate development will not only cease, but there may be actual retrogression. Development is already being seriously retarded by the delay in introducing the promised Distribution Bill, and it is important that it should not be further held up owing to possible differences on the municipal trading question.

Without entering into the pros and cons of municipal trading, it can be said definitely that there is more than a good case for its adoption, as several engineers have already advised their committees. The objection which is always put forward is that a municipal organisation should not compete with its own ratepayers, *i.e.*, the local contractors. This argument is based on the present idea of the electrical contractor as a simple retailer of electrical goods and appliances. The time has come for this idea to be replaced by the broader conception of the contractor as an essential part of the industry's selling organisation.

The supply authority has the greatest contact with the public, and is the key to the trading and development policy of the industry. It must, therefore, recognise the contractor's function in the future, just as the contractor must appreciate his obligation to co-operate with the supply authority. Many people will regard these ideas as impracticable, and will quote proverbs about teaching old dogs new tricks. It is admittedly difficult to change long-standing and cherished ideas, but at the present time it is more than advisable, it is imperative.

The difficulty is further magnified by the need for the changes to be accepted voluntarily by all the parties concerned. Any suggestion of compulsion would make the situation worse instead of better. Clearly, the only satisfactory method is to convince all the interested parties that they would each be better off as a result of the change. To point out abstract improvements in their position would be useless (except for an insignificant minority); the improvement must be measurable in terms of hard cash.

If the matter is looked into closely many of the apparent difficulties can be removed, and any proposals for changing existing relationships can be shown to be profitable to all concerned. First, consider the position which exists at present in an area where the supply authority does not sell goods and appliances to the public. Direct sales are made through three principal channels: the contractors, the hardware trade and the retail stores. Part of these goods pass through various wholesalers, and the remainder go direct from manufacturer to seller.

The first column of the accompanying table shows approximately the amount of gross profit per £100 spent by the public made by each of the various groups considered, on the assumption that the factory cost of an article is 60 per cent. of the list price, *i.e.*, 40 per cent. of the selling price to the public is devoted to the costs of distribution, selling and all profits. It will be appreciated that these figures are hypothetical, and they are only given as a guide to the line of approach which might be adopted.

PROBABLE EFFECT OF MUNICIPAL TRADING ON DIVISION OF PROFITS.

	Under present conditions	With municipal trading.	Mun. trading and turnover increased 50 per cent.
Manufacturer	£12	£10	£15
Supply authority... ...	—	£12	£18
Wholesaler	£1.5	£1	£1.5
Contractor	£12.5	£10	£15
Retail store	£9	£5	£7.5
Hardware trade	£5	£2	£3
Total ...	£40	£40	£60

The second column shows the revised distribution of the profits (gross), under a reasonable system of municipal trading, with the full co-operation of the contractors. These figures are based on the following assumptions:—

(i.) Extensive sales by the supply undertaking.
(ii.) A commission to the contractor on all business introduced by him.
(iii) Reduced direct sales by the contractor.
(iv.) The contractor purchases all goods for direct sale from the supply undertaking.

Again, the figures are hypothetical, but they give a fairly accurate picture of the results to be expected in practice.

Finally, the third column shows the profits on the assumption that the adoption of a bold municipal trading policy will increase the total volume of business by 50 per cent. This may appear to be excessive, but the limited data of results already obtained suggest that it is not unreasonable.

If we now compare the first and last columns in the table it will be seen that the position is improved for all except the retail store and the hardware trade (whose profits have slightly decreased) and the electrical wholesaler (whose position is unchanged). The manufacturer's profits have risen simply by virtue of the increased turnover, and the contractor's have also increased as the result of his sales work in conjunction with the supply authority. The lion's share goes to the supply authority, and it must be remembered that this profit is ultimately, and indirectly, applied for the benefit of the consumer, who, after all, is the most important factor.

Let it again be stated most emphatically that the figures given in the table are not to be taken as statements of fact. They are quoted to indicate a line of approach to the difficulties involved in the adoption of any system of municipal trading. Any figures such as these, which are required to support practical proposals, must be compiled specially, with an extensive knowledge of local conditions, before accurate inferences can be drawn from them. Even then they must be accompanied by a detailed report and the idea "sold" to the parties concerned by a man who is sympathetic and appreciates the difficulties of others.

With such data, carefully prepared, it should not be difficult to convince those interested that a system of municipal trading would not only improve the service given by the electrical industry to the public, but would also be of material financial benefit to themselves.

New Books

Television, Theory and Practice. Second edition. By J. H. REYNER. Pp. 221; figs. 126. Chapman & Hall, Ltd. Price 12s. 6d.

Since its publication in 1934, this book has been largely rewritten and considerably enlarged to cover most of the developments marking recent progress in practical television. The author's intention has been to set out first principles and by conveying fundamental information to make the book of service to the television engineer and experimenter. In this endeavour he has been markedly successful and only in a few instances does the phrasing lack lucidity.

The work is one of the first to deal with transmission lines although it does so only briefly, describing and illustrating co-axial types of cables. The description of cameras of the electron and of the iconoscope type is very much condensed into four pages and consequently the explanation of the way in which they function is somewhat sketchy although fairly clear to the thoughtful reader. The moderately recent development of velocity modulation is admirably explained and accompanied by excellent diagrams.

The probable trend of future progress towards true colour television and the use of larger screens is merely indicated, although the author cites as the ideal of all television experimenters the production of life size images, stereoscopic and in colour. Undoubtedly larger screens than the common 10 in. by 8 in. are essential and truer colour values desirable, because there is a risk that the present approach to the 10,000 mark in the number of receivers in use in the Home Counties, may well be near the saturation point as represented by the limited number of those attracted to television because of its novelty.

Throughout there are excellent illustrations and clear diagrams which, with the accompanying descriptions, make the book invaluable as a work of reference for the student and experimenter.

Steels for the User. By R. T. ROLFE. Pp. 280; figs. 90. London: Chapman & Hall, Ltd. Price 21s. net.

The author of this book is highly practical in his presentation of the text, which is the result of a long experience of the metallurgical industry.

After a short account of mechanical quality and its assessment, in which the various methods of steel testing are discussed, the whole question of the effect of composition upon the quality of the steel is dealt with. Mechanical quality of steel varies greatly with composition, and the influence of each of the separate constituents is considered, together with the general relationship between composition and quality in mild steel. From this it is clear that there is no particular difficulty in deciding upon the composition suitable for any required mechanical properties within the range of steels dealt with. An attempt is made at a general classification of carbon steels, according to their machining capabilities, so that from preliminary diagnosis one can deduce with reasonable certainty the probable behaviour in machining.

In dealing with the procedure necessary for the heat refining of steel castings the author makes reference to the factors involved, with a few examples of various industrial heat treatments. An admirable survey of case-hardening and building-up processes is followed by important sections relating to elevated temperatures with the effect of combined stress and temperature under service conditions. Although the general principles underlying the phenomenon of "fatigue" are now fairly well understood, thanks to the researches of Wöhler and Bauschinger, who laid the foundations of modern fatigue testing, their application is more difficult, but present knowledge is ably summarised.

In the final chapter consideration is given to the general principles which guide the selection of steels for service. The illustrations have been well chosen and the micro-photographs excellently reproduced.

Central Stations. By T. CROFT. (Revised by G. Hall.) (Third edition). Pp. 360; figs. 285. McGraw-Hill Publishing Co., Ltd. Price 18s.

In the preface to the first edition of this book the author stated that "a book on central stations must necessarily relate to the generation, transmission and distribution of electrical energy." His book consists of eighteen sections; of these only five, occupying 65 pages, are specifically devoted to power stations. The book is therefore of no value to experienced designers or operators in search of detailed information regarding the construction and characteristics of power stations. It has, however, gone through three editions between 1917 and 1937, and has therefore apparently been at least a partial commercial success and merits some consideration.

The first six sections deal clearly with nomenclature used in distribution and transmission practice and the factors used in analysing power system performance. Three sections deal with circuit design and four with particular pieces of equipment, such as lightning protective apparatus, voltage regulators, and switchgear. Thereafter come the sections directly concerning power stations and power plant, all of which are elementary and superficial, boilers, for instance, being treated in a single paragraph of about 16 lines.

The chief reason for its having reached a third edition is probably the scarcity of modern books of any kind about central stations. There is also positive merit in its clearness of exposition, enthusiastic and stimulating style, and here and there interesting crumbs of information. The figures are mostly elementary, and, in many cases, out of date. The printing and figure reproduction, on the other hand, are excellent.

Shorter Notices

The "*Mechanical World* Year Book" (Emmott & Co., 1s. 6d.) contains a new section dealing with electric arc welding, including methods of calculation for butt and fillet welds. The "Electrical Year Book," also 1s. 6d., has been revised, and particular attention given to power generation and distribution. Information is provided on phase sequence, symmetrical components, leakage protection, distance protection and the protection of a.c. motors. There are some new particulars regarding certain kinds of meters.

"Elementary Theory of Operational Mathematics." by E. Stephens (Pp. 313.) London: McGraw-Hill Publishing Co. Price 21s.

"Elements of Symmetrical Component Theory," by G. W. Stubbings. Pp. 104; figs. 60. Price 5s. "Television Reception Technique," by P. D. Tyers. Pp. 144; figs. 85. Price 12s. 6d. London: Sir Isaac Pitman & Sons, Ltd.

Presentation to Mr. J. W. Beauchamp

LEADERS of all branches of the electrical industry gathered at a dinner at the Waldorf Hotel, London, on Tuesday last in honour of Mr. J. W. Beauchamp, who recently retired from the position of commercial manager of the Central Electricity Board. About a hundred were present.

Mr. R. P. Sloan, C.B.E., was in the chair, and after dinner he proposed Mr. Beauchamp's health and gave an account of his career in rather ingenious verse, tracing his steps from Sheffield to West Ham, the directorship of the Electrical Development Association, South Wales and the Central Board. Mr. Sloan also read messages from a number of people who were unable to attend the dinner.

The toast was seconded by Mr. A. F. Berry, the first chairman of E.D.A., who said that Mr. Beauchamp was a man of high ideals and great courage as he proved when he launched E.D.A. practically without funds. His success was a matter of electrical history. He found all sections of the industry carrying out their propaganda separately and he brought them all together for a united effort. In referring to the difficulty of raising money for E.D.A. in its early days he paid a tribute to the late Mr. D. N. Dunlop for his help in persuading the B.E.A.M.A. that the money would be well spent. He did not think that the industry fully realised the power of the energy it purveyed. There was more to be done in the curative sphere by electricity than by any other industry. He urged them to consider this and place this country in the forefront of all others in the curing of disease. He concluded by saying that Mr. Beauchamp had justified himself to himself and his fellows and he (Mr. Berry) trusted that they would see him doing even greater work in his September days.

Mr. R. P. Sloan hands over to Mr. J. W. Beauchamp the grandfather clock seen in the background

Mr. Sloan then asked Mr. Beauchamp to accept from those present and many other subscribers a handsome modern grandfather clock.

In the course of his speech of thanks Mr. Beauchamp mentioned letters which he had received that evening from a number of friends. He confessed that although he was a thorough electrical man still he and his wife in their later days looked forward to sitting by an open fire listening to the long slow tick of the grandfather clock. He thought that the outstanding feature of the industry was the number of co-operative movements. The manufacturers' group had done excellent propaganda work second only to their technical achievements. He referred particularly to E.L.M.A. and its Lighting Service Bureaux, the first director of which, Mr. W. E. Bush, had been of great help to him in E.D.A.'s early days.

He commended to their goodwill E.D.A., its director and staff; the Association needed moral support even more than financial assistance. He suggested a new basis for contributions—so much (say 1s.) per consumer per annum, with a little bit added for output. By cultivating existing consumers the domestic load could easily be raised to two or two and a half times the existing load. He would also like E.D.A. to pay more attention to communal establishments. The right kind of propaganda could make customers clamour for more electricity in their restaurants, &c. There was an enormous field, for instance, in air conditioning.

Mentioning the probable advent of further electrical legislation, Mr. Beauchamp asked those present to remember the "gallant six hundred"—the managers of electricity undertakings great and small to whom the industry owed a great debt. He finished by saying that if he could no longer ride upon or drive the electrical chariot he would continue to run beside it.

In proposing the chairman's health, Mr. A. E. McKenzie mentioned Mr. Sloan's good work for E.D.A. Through his company he had subscribed more to the funds than anybody else and he had served upon the Council for an unbroken period of fifteen years, not missing a meeting. He was the only man who had been both president of E.D.A. and chairman of the Council.

Mr. Sloan, in response, thanked Mr. V. W. Dale and the Committee which had organised the dinner, for the excellent arrangements. The company then adjourned for a reunion.

Coal Research

THE Department of Scientific and Industrial Research has issued the report of the Fuel Research Board, with the report of the Director of Fuel Research, for the year ended March 31st, 1937 (Stationery Office, 3s.). The Board stresses the importance of treating coal before it reaches the consumer. The coal survey consists in the detailed examination of coals, both below ground and at the pit head, in nine laboratories in coal-producing areas.

The breaking of large coal to meet the demand for smaller graded sizes is being studied under industrial conditions at several collieries, as well as the extent to which unwanted breakage occurs during transit or storage. Over 100 different size grades (including "slacks") are marketed in Yorkshire, and a classification has been suggested to reduce the number.

The Fuel Research Station at East Greenwich has also dealt with the washing of fine coal, and the flocculation and treatment of slurries from washeries. Coal sprayed with from 3 to 20 lb. of oil per ton—according to the type of coal—does not raise dust when disturbed.

Regarding the production of oil from coal three types of process are under investigation—carbonisation, hydrogenation and the synthesis of carbon monoxide and hydrogen. In carbonisation, motor spirit, tar and oils are by-products, the main product being coal-gas, metallurgical coke or low temperature coke.

In the other processes the oils are main products, and their yields are higher. The production of motor spirit by hydrogenation is being studied both directly by hydrogenation of coal and indirectly by hydrogenation of tars produced by the carbonisation of coal. By the choice of suitable catalysts and operating conditions, the properties of the products may be varied to suit particular needs.

The synthesis of liquid hydrocarbons from mixtures of carbon monoxide and hydrogen provides a means of obtaining larger yields of oil from coal without the use of high pressures, and a plant, producing from 5 to 10 litres of hydrocarbons per day, is now in operation. Part of the liquid product can be converted by further treatment to lubricating oils. Other advantages are that the thermal yield is high, a new avenue is opened for the use of the larger quantities of low-volatile coals, and, by the substitution of non-caking coals for coke, the resources of caking coals will be conserved. The work has since been extended to include a wider range of coals, including high volatile coals. The conservation of the best coking coals is also the aim of a comprehensive investigation into the blending of coal.

The two types of burner developed at Greenwich for burning pulverised fuel for power production have been adopted in several industries. With pulverised fuel a Lancashire boiler fitted with a large economiser can produce five times its rated load of steam without serious loss in efficiency.

Attention is being directed to the use of pulverised coal in internal combustion engines, and experiments are being carried out on the wear of cylinder liners.

[In connection with the fuel-oil extraction processes mentioned above, attention may be drawn to the paper on "The Production of Synthetic Motor Spirits with Special Reference to the Fischer-Tropsch Process," which was presented recently by Dr. H. G. Shatwell to the North-Western Section of the Institution of Fuel at Manchester.—EDS. ELEC. REV.]

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

Central London Electricity, Ltd.

By an Order of the Court dated December 23rd, 1937, the following companies were amalgamated with the Charing Cross Electricity Supply Co., Ltd., which company has since changed its name to Central London Electricity, Ltd.:—Brompton & Kensington Electricity Supply Co., Ltd.; Chelsea Electricity Supply Co., Ltd.; Kensington & Knightsbridge Electric Lighting Co., Ltd.; St. James' & Pall Mall Electric Light Co., Ltd.; and Westminster Electric Supply Corporation, Ltd. All assets and liabilities of the amalgamating companies have been transferred to Central London Electricity, Ltd.

The Duke of Kent at the B.I.F.

The Duke of Kent will be principal guest at the Birmingham Chamber of Commerce annual banquet on February 28th, at which the Earl of Dudley, president of the Birmingham Chamber of Commerce, will preside. The guests include the French Ambassador and the President of the Board of Trade. On the morning after the banquet the Duke will visit the Engineering and Hardware Section of the British Industries Fair at Castle Bromwich.

E.D.A. Activities

In its Sales and Publicity Programme for February E.D.A. states that it is not too late to distribute the "film stars" calendar, a limited supply of which is still available. Attention is also directed to the calendar blotters, and a 6-page electric cooker folder which can be conveniently enclosed in account envelopes. The Association still has available posters, folders, window displays, Press advertisement stereos and the children's painting competition books in connection with the "Better Light—Better Sight" Campaign, and "The Way to a Good Table," the book on electrical cooking by Elizabeth Craig, is suggested as a New Year gift to users of electric cookers. An inexpensive form of propaganda is the issue of whist score cards which the Association has produced in three colours.

A Refrigerator Convention

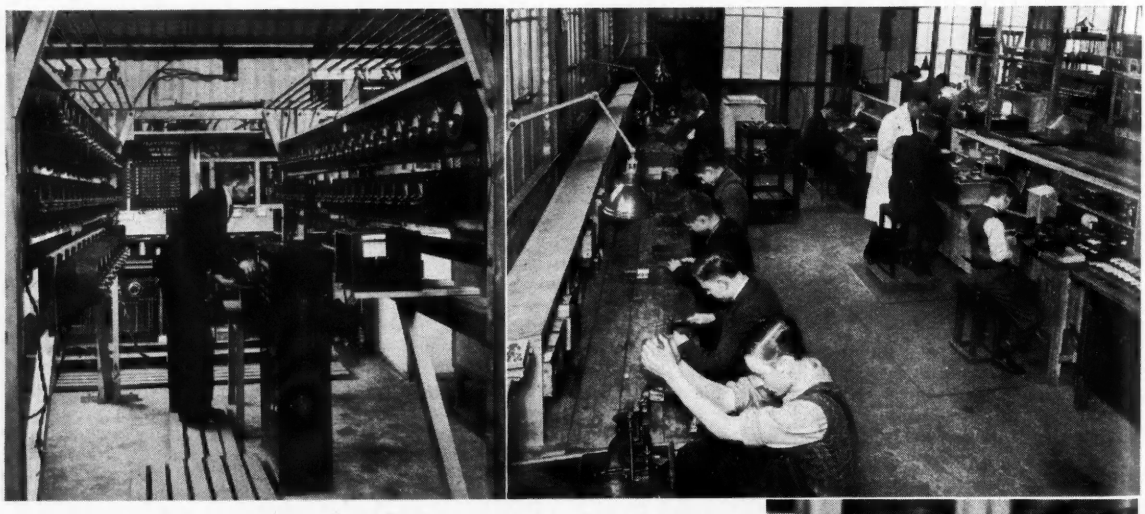
More than 400 distributors of B.T.H. refrigerators met at the May Fair Hotel, London, on Monday last for the fifth annual Convention of the International Refrigerator Co., Ltd. During the morning session, which dealt with commercial refrigeration, there were papers by Mr. C. W. Barrett, commercial engineer, on "New Developments in 'Coldrator' Refrigeration"; by Messrs. W. J. Creemer (Creemer, Ltd.), C. Kilman (Automatic Refrigerator Co., Ltd.), and A. A. Greenwood (Modern Refrigerator Sales, Ltd.), on the selling side; and by Mr. E. Willetts, Midland district manager, on drink cooling. The afternoon session dealt with domestic refrigeration and, concerning mainly the sales side, included papers by Messrs. J. F. Stewart, chairman of the company; G. N. Robbins, Provincial Sales Department; H. C. Timewell, joint managing director; A. R. Crew, Sales Promotion Department; E. H. Walsh, London Sales Department, and R. G. Scott (Scott & Scott, Ltd.). After tea Mr. G. Bowles (East Anglian Electric Supply Co., Ltd.) spoke on "kWh and B.th.u.s," and Mr. E. G. Plucknett, sales manager, central division electricity supply undertakings, dealt with "Load Curves and Sales Curves." At the banquet in the evening Mr. J. F. Stewart, the company's chairman, proposed the toast of "The B.T.H. Co.," a response being made by Mr. H. N. Sporborg, director and chief engineer of the B.T.H. Co., Ltd., Rugby. His remarks on the manufacture of the refrigerators are given on page 58 with a description of the company's new model. Mr. R. J. Simpson, joint managing director, in proposing the toast of the guests, said that the head office would shortly be moved to a large building known as 3 and 4, Hanover Square, London. Mr. P. J. Kelly, managing director of the Edison Swan Electric Co., Ltd., replied to the toast. Subsequent to a cabaret, Mr. H. C. Timewell introduced the new refrigerator.

Sound Film Patents in the United States

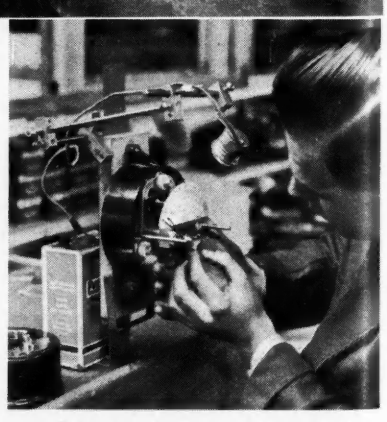
The New York correspondent of *The Times* reports that suits were filed on January 10th in the United States District Court at Wilmington, Delaware, by British Acoustic Films, Ltd., a subsidiary of Gaumont British, against the R.C.A. Manufacturing Co., Inc., a subsidiary of the Radio Corporation of America, and Electrical Research Products, Inc., a subsidiary of the Western Electric Co., in which the plaintiff seeks an injunction restraining the two defendants from manufacturing and distributing motion picture equipment on the ground that in so doing they infringe patents owned by the plaintiff. Since the two defendant companies manufacture and distribute almost all the sound equipment in the United States a decision for the plaintiff would affect almost every American cinema theatre and many others throughout the world. It is expected that British Acoustic Films, Ltd., will claim damages of between $10,000,000 (£2,000,000) and $20,000,000 (£4,000,000). Two patents are involved in the suits. The first is "a device for feeding acoustic film at constant speed," which it is claimed is covered by an American patent of 1926, and the other is "constant speed film feeding mechanism," patented in America in 1935.

An Instrument Factory Extension

So great has been the recent increase in the sales of their maximum demand and load indicators that during the past three or four years Price & Belsham, Ltd., have trebled both their factory area and employés. The latest extension to their Tamworth Lane Works, Mitcham, just completed, represents about a quarter of the total floor area available and is being used for instrument assembly and for the provision of a very much larger and better equipped test room than before. The old test room has now been converted into offices, and the remainder of the space freed in the original factory permits a general improvement of the machine shop, the component production department and the packing room. The factory



Above: The new test room and assembly section in the latest extensions to the factory of Price & Belsham, Ltd., at Mitcham. Right: Final adjustment of a maximum demand indicator before calibration [*Elec. Rev. photos.*



is remarkably self-contained, practically all the components and accessories (apart from the actual castings), as well as most of the tools required, being made on the premises. Thirteen different types of maximum demand indicator, covering the requirements of both electricity suppliers and consumers, are already available and include switchboard, flush, long scale, pedestal, portable and alarm models and also one incorporating a current limiting transformer. As a result of the additional accommodation now provided it is possible to introduce low range and long scale portable models, and furthermore the "HSI" consumers' type is to be supplied if required in bakelite cases. A special feature of all these indicators, Mr. E. F. Evenden, one of the company's directors, told us, is that every scale is individually drawn, thus ensuring maximum accuracy. Apart from specialising in these indicators the company includes among its manufactures such articles as cable tracers and fault locators, self-calculating bridges for cable fault detection, capacity measurers and the "Easifix" live line tapping system and earthing clamps. Split core current transformers, of which there is also a considerable output, are finding increasing applications for permanent as well as for temporary installation.

Irish Electrical Imports

In almost every section, with the notable exception of electric lamps, imports of electrical goods and apparatus into Ireland during the eleven months January-November last showed increases compared with the corresponding period of 1936. The greatest increase occurred under the heading "telegraph and telephone apparatus," the value of imports in 1937 being £96,659, against £41,735 during the first eleven months of 1936. Most of this increase can be accounted for by the improvements carried out during the year in both external and internal communication systems by the Department of Posts and Telegraphs. Broadcast receivers advanced by over £10,000, electrical machinery other than motors by over £36,000, and "other electrical goods and apparatus" by over £24,000. Imports of electric lamps fell by £26,000 as compared with 1936, due to the protective tariffs imposed by the Government as a fillip to home production.

	January-November 1936.	1937.
	£	£
Electrical machinery :		
Motors...	49,722	52,838
Other sorts, not enumerated separately	193,726	230,129
Dry batteries, complete	15,801	16,117
Dry batteries, parts of...	4,018	4,197
Electric lamps	47,053	20,943
Electric lighting accessories, fittings and parts	74,713	75,744
Electric wires and cables, insulated	94,596	91,101
Telegraph and telephone apparatus, not enumerated separately	41,735	96,659
Radio telegraph apparatus :		
Broadcast receivers, fully manufactured	98,305	108,307
Radio-gramophones, fully manufactured	2,919	2,516
Other sorts, fully or substantially assembled	8,726	11,590
Component parts and accessories	102,989	107,286
Other electrical goods and apparatus	285,546	309,938
Total	£1,019,849	£1,127,365

New Electricity Showrooms

Brierfield Urban District Council's electricity undertaking has taken over premises at 40, Colne Road as a permanent electricity showroom and offices. The existing showroom near the Town Hall will be converted into meter-testing quarters and meter store to comply with the Meters Act (1936).

Stockport Corporation Electricity Committee has under consideration a site near Adlington Square and the new River Mersey Road with a view to erecting a showroom and meter-testing station.

A Disclaimer

Brown Brothers, Ltd., ask us to state that a rumour to the effect that they are to close down their Radio Department has gained currency during the last few days. We are authorised by them to refute this as they have no intention of closing the department.

Australian Electrical News

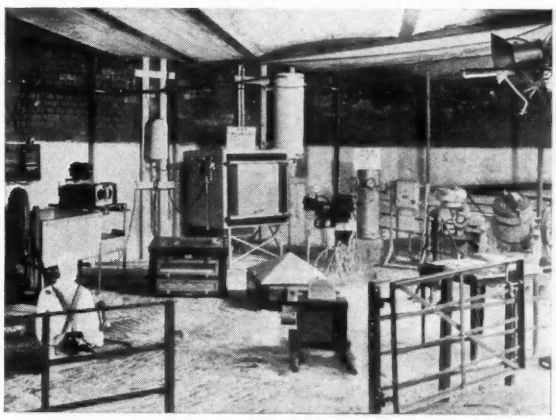
Our Australian correspondent reports that according to authorities in Sydney the general standard of home lighting throughout the metropolitan area is poor. An expenditure by the County Council of £15,700 on a "Better Light—Better Sight" campaign has been recommended; this will include a canvass of the homes of selected groups of customers.

The fact that faulty electrical apparatus and installations have resulted in a number of deaths has evoked a good deal of comment throughout New South Wales. In one case a woman was killed while using an electric washing machine, the installation of which had been altered by her husband, who was not a licensed electrician. The latter was subsequently committed for trial on a charge of manslaughter, but the Attorney-General decided not to file a bill against him. A plan has been put forward by which the Sydney County Council would inspect the electrical installations of all its consumers within two and a half years at an approximate cost of £36,000 a year. It is anticipated that such an inspection would reveal the necessity of repairs to about 25 per cent. of installations; 2,000 inspections per week would be required, and nearly sixty extra employés would be needed. The Minister for Works and Local Government (Mr. Spooner) has stated that immediate action is necessary, but the question of who will have to meet the bill is causing some discussion. Children are being warned against the dangers of contact with wires when roof climbing—a popular pastime in districts where the majority of houses are of the bungalow type. One fatality which gained much prominence was at Dorrigo, where a defective lamp was the cause. An inspector of the Department of Works stated that one of the contacts of the lamp showed a small portion of possibly a 36-gauge wire protruding from it, a defect he had never before seen. A test made after this discovery revealed a full 240-V potential to earth.

In the matter of electric lighting the public of Western Australia is being governed under an Act of 1892, which has been amended from time to time, but which is hampering electrical development in the State. A Bill is now being introduced in Parliament to set up a competent committee to advise the Minister, to provide power to deal with radio interference, and to establish more effective general inspection of electrical equipment, apparatus and installations.

Electricity at a Cattle Show

A successful exhibition of electrical farming, dairy and poultry appliances was arranged by the Hull Corporation Electricity Department on the occasion of the Hull and District Christmas Fat Stock Show. The show was held in the Hull Cattle Market and was the third of its kind. Despite the inclement weather there was an excellent attendance, and entries for the competitions constituted a record, numbering about 550 in all. The Hull Electricity Department's stand



Hull Electricity Department's display at the local Christmas Fat Stock Show

was housed in the sheep pen alley, a commodious and prominent corner of the market, and was illuminated by two 500-W floodlights. The apparatus shown included the following:—Skidmotor, clipping machines, shearers, stunner, milking machine, steam raiser, sterilising chest, bottle washer, cream separator, butter churn, incubator, hover, poultry plucking machine, and domestic water heaters. A special installation of electricity and water allowed most of the exhibits to be demonstrated in a practical manner. By the time of closing down a satisfactory amount of business had been done, both in actual sales and in "getting the story home," which together with the interest displayed by the visitors definitely made the project worth while.

Electrical Commercial Travellers

The annual dinner of the Electrical Trades' Commercial Travellers' Association will be held on January 28th at the Connaught Rooms, Great Queen Street, W.C.2, at 6.30 for 7 p.m.

Social Events

About 2,000 members of the Hoover London sales staff and their friends gathered on Thursday last week at the Hotel Great Central for their annual New Year social and dance. So large was the party that it monopolised almost the whole of the ground floor of the hotel, including the Wharncliffe Rooms and Winter Gardens, where two dance bands were playing. A cabaret was also given. A further two thousand guests from the Hoover factory were entertained on the following day.

The annual dinner and dance of the Plymouth Corporation Electricity Department was held on January 7th at the Continental Hotel. Councillor F. G. Leatherby, chairman of the Electricity and Street Lighting Committee, in proposing the toast of the electricity undertaking, referred to the progress which had been made in recent years and mentioned that in 1915, following the amalgamation of Plymouth, Stonehouse and Devonport, five and a half million kWh was sold within the city boundary. It was estimated that over 47 million kWh would be sold in the year ending March 31st next. Despite increases in expenditure due to the rising cost of coal and higher wages, an increase in the charges for electricity was improbable. He referred to recent improvements in the street lighting of the city and to further proposals in this respect. Mr. H. Midgley, the city electrical engineer, in reply, gave further statistics showing the growth of the undertaking, and referred to the social activities of the Department. The health of the visitors was proposed by Mr. W. A. Gallon, chief assistant engineer, and Mrs. G. A. Daymond, acting president of the E.A.W. (Plymouth Branch), responded. Mrs.

Daymond presented Miss E. M. Edwards, a demonstrator in the employ of the Electricity Department, with the Elizabeth Sloan Chesser cup, presented to the demonstrator who obtains the highest marks nationally in the test for the Electrical Housecraft Diploma. Miss Edwards wins the cup for the year of its inception. Following the dinner cups and prizes were presented to members of the various sports organisations of the undertaking.

The New Year's party of Crompton Parkinson's London staff was held at the Royal Hotel, Woburn Place, on January 7th. A number of games and competitions, a six-course dinner, dancing and a cabaret helped to keep the 270 guests fully engaged during an enjoyable evening. There was but one short speech, to welcome Mr. Antel, chief engineer to Crompton Parkinson (South Africa), Ltd. Mr. T. H. Windibank was M.C.

Simplex Electric Co., Ltd., recently held its staff Christmas party and carnival dance. The Social Club headquarters at Broadwell Road, Oldbury, were used for the occasion. The ballroom was gaily decorated, and the lounges and buffet provided ample accommodation for the gathering of over 400. The arrangements were made by a committee representing all sections of the staff. The programme included dancing, games, competitions and entertainments. A room was reserved as a "casino" and provided many competition games for which excellent prizes were awarded. Prizewinners were announced by Mr. J. Huntington (director) and were presented by Mrs. Huntington and Mrs. E. A. Edwards.

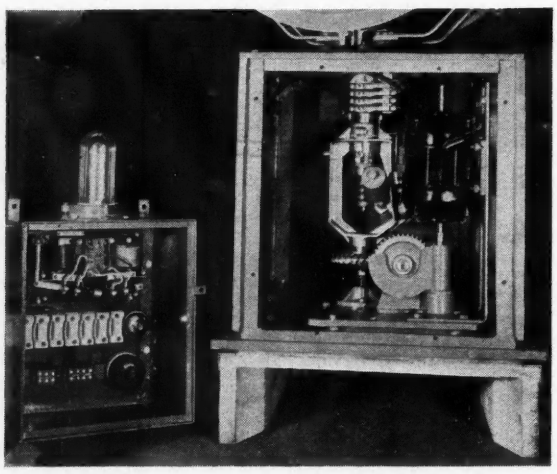
Trade Announcements

The Tunnel Asbestos Cement Co., Ltd., has concluded an agreement with Turners Asbestos Cement Co. (branch of Turner & Newall, Ltd.), whereby that company will exclusively market all Tunnel Asbestos Cement Products. In consequence of this arrangement, the selling organisation of the Tunnel Asbestos Co., has been discontinued and the company's activities are now vested solely in the manufacturing side of the business.

The following companies have changed their telephone numbers, and the new numbers are shown in parentheses:—British Oxygen Co., Ltd. (Victoria 8477); Chloride Electrical Storage Co., Ltd. (Victoria 2299); Smith's (Dishwashers), Ltd. (Prospect 1197); Thomas Broadbent & Sons, Ltd. (Abbey 2484 and 5).

Quick Delivery

Twenty-four floodlights were rushed to Southampton on Monday last in a last-minute attempt to catch a seaplane for Cairo where they are needed in the decorations for the wedding of King Farouk on January 20th. An urgent order from the Egyptian Office of Works had been cabled to the General Electric Co., Ltd., which immediately communicated with the airways authorities in an endeavour to get the equipment despatched within a few hours on its journey of 2,500 miles. The seaplane was due to leave on Tuesday morning and was expected to land on the Nile yesterday (Thursday). As the exact number of passengers was unknown on Monday and the absence of two passengers would mean that 200 lb. more freight could be carried, it was arranged that the whole of the equipment, in thirty packages, should be at the docks and as much of it as possible would be taken aboard. The remainder was to be flown to Alexandria yesterday (Thursday), completing by rail the 116-mile journey to Cairo where it will arrive during the week-end. Local engineers will have three days to install the floodlights before the royal wedding. The cost of the floodlights is about £200, and they are similar to those used at St. George's Chapel, Windsor, during the Coronation celebrations. The equipment was manufactured at the Birmingham works of the G.E.C. and was supplied from stock in London.



The G.E.C. has recently received an order for rotating air route beacons for Australia. Our picture shows the interior of the equipment and control box for a 24-in. diameter beacon

Orders Recently Booked

The English Electric Co., Ltd., has received a contract from the Bradford Corporation for fifty-seven complete trolley-buses. These will be of the two-axle type with double-deck, all-metal bodies, providing seating accommodation for fifty-six passengers. The vehicles will be provided with low-voltage lighting throughout, and forty-two of them will be on A.E.C. chassis. They will be fitted with 80-h.p. motors, and control will be by means of the English Electric Co.'s series dynamic system. The decision of Bradford Corporation to adopt series dynamic control follows extensive trials which it has carried out with this type of control.

Faster "Underground" trains are needed to cope with London's rush-hour traffic, hence the necessity of economising weight on the new rolling stock now under construction. Kryn & Lahy (1928), Ltd., have received an order for more than 7,000 cast-steel wheel centres for these trains. In order to save weight, these wheel centres have been designed with lighter sections than in the past, but the margin of safety is maintained by the use of a special steel developed by the company.

A New Use for a Laundry Iron

Thieves who broke into the premises of Premier Electric Heaters, Ltd., Birmingham, in the early hours of Sunday morning last used a 12-lb. laundry iron from the showroom as an instrument for breaking into the general office. After vainly trying to open the safe they ransacked the desks and other offices, where their total haul was a small amount of petty cash, two electric irons, a pair of spectacles, and a pair of ladies' stockings. The company informs us that the laundry iron is very little the worse for its unusual experience.

Batti-Wallahs' Luncheon

The next luncheon of the Batti-Wallahs' Society will be held on January 27th at the Hotel Victoria, W.C., when Lord Sempill will speak on "Commercial Aviation as a World Force."

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, ETC.	Price January 12th.	Fortnight's Inc. or dec.
a Acid Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£36	—
a Ammonia, Muriate (large crystal)... ... „	£18 10s.	—
a Borax ... ... „	£17	—
a Copper, Sulphate ... ... „	£22 10s.	—
a Potash, Chlorate ... ... per lb.	3¾d. to 4¾d.	—
a „ Perchlorate ... ... „	6d.	—
a Shellac ... ... per cwt.	£4 18s.	—
a Sulphur, Commercial ... ... per ton	£11	—
a „ Roll... ... ... „	£11	—
a Soda, Chlorate ... ... per lb.	3½d. to 3¾d.	—
a „ Crystals ... ... per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... ... per lb.	4d. net.	—
METALS, ETC.		
b Aluminium, Ingots ... ... per ton	£100 to £105	—
b „ Wire ... ... per lb.	1/1 to 1/9	—
b „ Sheet and Foil ... ... „	1/3 to 2/9	—
p Babbitts Metal and Anti-friction Metals—		
Grade I ... ... per ton net	£187	—
Grade II ... ... „	£131	—
Grade III... ... ... „	£76	£1 inc.
c Brass (rolled metal 2" to 12" basis)... per lb.	8½d.	—
c „ Tubes (solid drawn) ... ... „	11½d. to 11¾d.	½d. inc.
c „ Wire, basis ... ... „	8¾d.	½d. inc.
c Copper Tubes (solid drawn) ... ... „	1/0¾	½d. inc.
g „ Bars (best selected)... ... per ton	£74	£2 dec.
g „ Sheet... ... ... „		
g „ Rod ... ... „		
d „ (Electrolytic) Bars ... ... „	£49	£5 inc.
d „ „ Wire Rods ... ... „	£54 10s.	£5 inc.
d „ „ H.C. Wire ... per lb.	8¾d.	½d. inc.
f Ebonite Rod ½" dia. & up ... ... „	1/10 to 2/5	—
f „ Sheet ⅛" thick & up ... ... „	1/5 to 1/10	—
n German Silver Wire, Nos. 1 to 12... ... „	2/4	—
h Gutta-percha, fine ... ... „	nom.	—
h India-rubber, Para-fine ... ... „	7¼d.	¼d. dec.
i Iron, Pig (Cleveland, No. 3) ... per ton	£4 5s.	—
i „ Wire galv. No. 1 P.O. Qual.... „	£23	—
g Lead, English Pig ... ... „	£19	£1 5s. inc.
g Mercury ... ... per bot.	£12 17s.	3s. dec.
e Mica (in original cases) small ... per lb.	10d. to 2/–	—
e „ „ „ medium ... „	6/– to 12/6	—
e „ „ „ large ... „	13/– to 17/6 up	—
p Phosphor Bronze, plain castings ... „	1/2¼	—
p „ „ drawn bars & rods „	1/1½	—
p „ „ rolled strip & sheet „	11d.	—
p „ „ wire ... ... „	1/0¾	—
o Platinum ... ... per oz.	£7	12s. 6d. dec.
d Silicium Bronze Wire ... ... per lb.	9½d.	½d. inc.
g Spelter ... ... per ton	£15 15s.	12s. 6d. inc.
g Tin, Block (English)... ... ... per ton	£188 15s.	10s. inc.
n „ Wire, Nos. 1 to 16 ... ... per lb.	4/3	—

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g Henry Gardner & Co., Ltd.
h Edward Till & Co.
i Bolling & Lowe.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead, rubber, tin and spelter, up to the time of going to press, are given in our "Business Notes" under the same heading.

Meter Test Room Clocks

In our mention last week (p. 5) of the meter test room clocks made by John Smith & Sons, Derby, we implied that the clock error was 15 sec. in 24 hours. Actually it is only 1.5 sec. (or 0.002 per cent., as we stated).

Buildings of the Future

Changing conditions of modern life and the introduction of new building materials are evolving an architecture in which the nineteenth-century love of academic style and decoration is being discarded in favour of simplicity, technique, and of the requirements of the people who use it. That this new architecture not only has its utilitarian advantages, but possesses a beauty of its own is forcefully demonstrated by an exhibition which the Mars (Modern Architectural Research) Group opened at the New Burlington Galleries, Old Bond Street, W.1, on Tuesday. The exhibits, which consist mainly of large photographs and diagrams, emphasise the various architectural requirements of the community, family and individual for work and pleasure. A particularly interesting example of the effectiveness of breaking away from convention for the purpose of meeting a particular need is to be found in a model living-room in which all the furniture such as cupboards, book-cases, electric fire, radio, gramophone and television are built into the walls. This theme of "form and purpose" does, in fact, go far beyond the building itself and embraces all within. In the section of the exhibition dealing with machinery, for instance, it is pointed out that "modern machinery must not only be exact and unvarying in performance, but it must be faultless in appearance and technique." Typical modern apparatus shows how this can be achieved. The exhibition will remain open until January 29th.

English Electric Engineering Society

The annual smoking concert of the English Electric (Stafford Works) Engineering Society was held on January 5th, being attended by over 300 members. The chair was taken by Mr. J. Bissett (chairman), general manager of the company's various works, and he was supported by a large number of prominent officials of the company. A telegram was read from Mr. G. H. Nelson, chairman and managing director, wishing the Society continued success. Mr. J. Rogers, general manager, proposed the toast of "The Company," which was responded to by Mr. A. D. Sloan, chief engineer. The toast of the "Engineering Society," proposed by Mr. C. Hollander, commercial manager, was replied to by Mr. A. T. Chadwick, chief transformer engineer. A vote of thanks to the chairman for presiding was proposed by Mr. F. Wallis, assistant chief engineer. The membership of this Society now totals 790.

New York World's Fair

The British Empire has contracted for 140,000 sq. ft. of space at the New York World's Fair of 1939. The Department of Overseas Trade announces that Sir Louis Beale has been appointed Commissioner-General for the United Kingdom section of the Fair.

Advertisement Correction

In the advertisement of the Donovan Electrical Co., Ltd., in our January 7th issue, the company's two-step automatic starters were described as for use with "time shafting." This, of course, should have been "line shafting."

The Electrical Wholesalers' Dinner

The annual dinner of the Electrical Wholesalers' Federation will be held at the Savoy Hotel, W.C.2, on March 17th.

Import Duties Act Notice

The Board of Trade, in exercise of the powers conferred on it by Section 9 of the Import Duties Act, 1932, as extended by Sections 9 and 20 of the Finance Act, 1933, has given notice that it will require returns in relation to the year 1938 to be delivered to it in accordance with the provisions of the first above-mentioned Section in respect of the manufacture in the United Kingdom of goods of any class or description which, if they were imported into the United Kingdom, would be chargeable with a duty of Customs under any of the enactments following, namely:—The Safeguarding of Industries Act, 1921; the Finance Act, 1925, Section 3; the Import Duties Act, 1932, Part I; and the Finance Act, 1933, Section 9.

Long-service Certificates

On Tuesday last employés of the Anchor Cable Co., Ltd., who have qualified received long-service certificates. The presentations took place in the works canteen in the presence of directors of the company and of Callender's, and the workpeople. The qualification is twenty-five years, and there were forty-two recipients, all except one being men. All had already received the cheques which are awarded with the certificates. Sir J. Fortescue Flannery, Bt., chairman of Callender's, presented the certificates.

Calendars and Diaries

As in previous years, the block calendar of the Davenport Engineering Co., Ltd., has a picture above it of the company's cooling towers.

The calendar of the Revo Electric Co., Ltd., has a view of the company's works over large daily slips with bold red figures.

The neat wall calendar of Nalder Bros. & Thompson, Ltd., has monthly slips and directs attention to the company's electrical instruments and relays.

An engagement calendar has been received from the Portable Furnace & Patents Co.

The neat calendar of Corfield Sigg, Ltd., has a well-executed etching of Merton Abbey.

An illustration of one of the company's locomotives appears above the calendar of Peckett & Sons, Ltd., which has monthly slips showing the preceding and following months.

Anglo-American Trade Talks

The Foreign Office has announced that Sir Ronald Lindsay, British Ambassador at Washington, and Mr. A. E. Overton, Joint Second Secretary to the Board of Trade, will be the United Kingdom delegates in the forthcoming negotiations with the United States. The delegates will be assisted by officers of the Board of Trade and of other departments. Mr. H. O. Chalkley, Commercial Counsellor at Washington, will be adviser to the delegation. It is expected that the discussions will begin at Washington about the middle of February.

Electrical Contracting at Worthing

Worthing Town Council has approved a recommendation of the Electricity Committee that, subject to the terms of an agreement to be prepared by the town clerk, the Worthing sub-branch of the Electrical Contractors' Association shall be appointed to execute all wiring and plumbing work on consumers' premises in connection with apparatus hired from the Corporation for a further period of one year.

Electric Lift Installations

Marryat & Scott, Ltd., have sent us a number of sheets containing lists of hospitals, flats, hotels, factories, offices, and other public buildings in this country in which the company's lifts have been installed, and also a list of some recent export contracts.

New Catalogues and Lists

British Insulated Cables, Ltd., Prescot.—Details of 5-core pillar units.

Klaxon, Ltd., 36, Blandford Street, London, W.1.—A complete catalogue of fractional h.p. motors.

Ruston & Hornsby, Ltd., Lincoln.—A brochure dealing with horizontal heavy-oil engines.

Siemens & General Electric Railway Signal Co., Ltd., East Lane, Wembley.—Details of a universal relay for signalling circuits.

London Electric Clock Co., 15, Park Street, Islington, London, N.1.—A catalogue of "Tim" synchronous clocks.

Electrical Supplies (Bloxwich), Ltd., Bloxwich, Walsall.—A trade list of all-steel conduit joints and boxes.

Davis Bros., Ltd., 22, Buckingham Street, London, W.C.2.—A 28-page catalogue of modern lighting fittings of the decorative, floodlight and sign type.

Eca-Ray Sales, Ltd., 12a, Bouchier Street, London, W.1.—A catalogue of lighting units and fittings.

Bankruptcy Proceedings

W. S. Poole, High Street, Queensbury, near Halifax, electrician and wireless dealer.—The public examination was held at the County Court, Prescott Street, Halifax, on January 7th, and was closed. The statement of affairs showed a deficiency of £108. Debtor stated that his wireless business was good until 1933, when there was a slump and he had to dispose of stock at a loss, and subsequently his expenses were increased by illness.

F. S. Moses, electrical contractor, 9, Thorney Lane, Midgley, near Halifax, formerly trading at 3, Bank Side, Hebden Bridge, and 9, Thorney Lane, Midgley.—First meeting January 14th at 71, Manningham Lane, Bradford. Public examination February 4th at the County Court, Prescott Street, Halifax.

G. C. Spong and **J. H. Trussell** (C.C.S. Trading Co.), electricians, 30, Western Mail Chambers, Cardiff. (Separate application of G. C. Spong).—Application for discharge to be heard on February 2nd at the Law Courts, Cardiff.

S. Patterson, electrician, 55, Aberdeen Walk, Scarborough.—Discharge suspended for six months until June 14th, 1938.

E. C. Mould (Empire Electrical Co.), electrical retailer, 24, Westrow Gardens, Seven Kings, Essex.—Public examination February 2nd at the Shire Hall, Chelmsford.

W. G. Johnson, radio dealer, 71, High Street, Smethwick.—Public examination February 4th at the Law Courts, West Bromwich.

F. L. Wainwright, radio dealer, 114, Kimbolton Road, Copnor, Portsmouth, lately trading at 42, South Street, Yeovil.—Trustee, Mr. A. L. Medcalf, 87, High Street, Portsmouth, Official Receiver, released December 21st.

J. Conlon, electrical engineer, 1b, Buckingham Street, Hull.—Trustee, Mr. J. E. D. Stickney, 1, Parliament Street, Hull, Official Receiver, released December 31st.

Company Liquidations

Rural Electricity Supply Co., Ltd.—Particulars of claims by February 10th to the liquidator, Mr. J. M. Davies, Bush Lane House, Bush Lane, E.C.4. Meeting February 18th at Bute Street, Cardiff, to receive an account of the winding-up by the liquidator.

Gordon Radio, Ltd.—Winding up voluntarily. Liquidator, Mr. B. Leigh, 186, Bishopsgate, E.C.

Newbury Radio Co., Ltd.—Winding up voluntarily. Joint liquidators, Mr. C. Latham, 185-188, High Holborn, W.C.1, and Mr. C. S. S. Cowper, 4, Walbrook, E.C.

J. Wride's Radio Depot, Ltd.—Particulars of claims by February 1st to the liquidators, Messrs. F. E. Bendall and N. W. Peeling, 31, Lloyd Street, Manchester, 2.

A.B. Electric Co., Ltd.—Meetings February 11th at 4, Charterhouse Square, E.C.1, to receive an account of the winding-up by the liquidator, Mr. F. E. Bendall.

Electricity Supply

Lighting, Domestic, Power

Barrow-in-Furness.—LOANS.—Sanction is being sought by the Electricity Committee to borrow £6,000 for meters. It has obtained permission to borrow £13,017 for building extensions at the power station.

Bedwellty.—CHEAPER LIGHTING.—The Urban District Council is reducing the charge for electricity for lighting by 1d. per kWh.

Birkenhead.—CLAIM BY WALLASEY COPPORATION SETTLED.—A claim by the Wallasey Corporation for the payment of over £4,600 has been considered by the Birkenhead Electricity Committee. This is stated to be the amount of an undercharge made to the Birkenhead Corporation for electrical energy supplied from October 1st, 1931, to December 31st, 1933, under an agreement for a bulk supply of electricity, due to an omission to make the necessary adjustment in respect of the cost of fuel. The Birkenhead Electricity Committee recommends that the Council shall agree to a payment of half of the amount of the claim in full settlement. Wallasey accepts this compromise.

MAINS AND SERVICES.—Application is being made by the Electricity Committee for sanction to a loan of £75,000 for unspecified mains and services.

Blackburn.—CABLES AT SUPPLY BOUNDARY.—The Accrington Corporation Electricity Committee is opposed to the new Blackburn Corporation Parliamentary Bill, which is in similar terms to a section of an Accrington Corporation Act. It seeks power, where the limits within which the Corporation is authorised to supply electricity are bounded by or abut on any road, to extend such limits a further distance of one hundred yards. The Accrington Corporation has already installed cables in the roadways abutting on the Blackburn Corporation's limits of supply.

REPORT ON STREET LIGHTING.—The Street Lighting Committee recommends that the borough engineer, in collaboration with the gas and electrical engineers, shall prepare a report on street lighting to incorporate present lighting costs, estimated capital cost of improving the present lighting to the appropriate standard by gas and electricity, and estimated cost of maintenance, renewals and repairs.

Blackpool.—ELECTRICITY FOR PUMPING STATION.—Sanction is being sought by the Electricity Committee to a loan of £12,435 for feeders and switchgear for an electricity supply at the Lennox Gate pumping station.

Bridlington.—CABLES.—Additional cables are to be laid and a kiosk erected in Royal Prince's Parade at a cost, including equipment, of £3,200.

Bury St. Edmund's.—PROPOSED SALE OF UNDERTAKING.—At a special meeting of the Town Council last Friday it was unanimously agreed to sell the municipal electricity undertaking to the East Anglian Electric Supply Co., Ltd. A specific amount of £100,000 is mentioned in the sale agreement, but the showroom would remain the property of the Corporation, the reserve fund, amounting to nearly £7,000, would be retained and stocks and stores would be paid for in addition, so that the figure would approximate to £115,000. After paying off the outstanding debt on the undertaking there would be a surplus of at least £20,000 available for rate relief. By the tariff agreement, forming part of the conditions of the sale, Bury St. Edmund's is to be treated as a separate entity so far as the accounts are concerned, and if it transpires that the profits of the company as a result of the sale of electricity in the borough are excessive the Corporation will be able to apply for a revision of tariffs at intervals of five years, or less, if desired. The company has agreed to a reduction in the domestic tariff by charging ¾d. per kWh for the first 200 kWh consumed during the winter quarters instead of the existing 1d. per kWh. The company has agreed that the charges at present in force for the public lighting of the town shall remain for twelve months, after which they will be subject to negotiation.

Caerphilly.—RE-ACQUISITION OF UNDERTAKING.—At a meeting of the Urban District Council last week an agreement for the re-acquisition of the electricity undertaking in the Caerphilly area from the South Wales Power Co. was sealed. The undertaking includes the lighting, &c., of the Caerphilly area with the exception of the two Caerphilly wards, both of which were previously under the Council's jurisdiction. The Council is paying the company £80,000.

Cardiff.—COOKER HIRE TERMS.—The following terms for the hire of cookers have been approved by the Electricity Committee: Minor size 4s., small size 4s. 6d., medium size 5s. 6d. and large size 6s. per quarter, including an electric kettle in each case. The quarterly charge is to be reduced by 6d. each year to a minimum of half the initial charge. Generally, wiring up to 60 ft. is free, but this does not apply to the minor type apparatus.

Chesterfield.—STREET LIGHTING.—The Lighting Committee has approved a revised estimate of £1,626 for lighting Chatsworth Road and West Bars.

Colchester.—SUPPLY EXTENSIONS.—The Town Council is to furnish an a.c. supply to the works of the Britannia Lathe Co. This will involve the laying of a cable from Osborne Street to the Britannia Works at an estimated cost of £500. It is also proposed to afford a supply of electricity to Little Bentley at an estimated cost of £1,136.

Dereham.—REQUEST FOR EXTENSION.—The Urban District Council has received a memorial from the residents in Littlefields for an extension of the electricity mains to this district. An estimate is being prepared.

Dudley.—POINTS IN COUNCIL HOUSES.—The Shropshire, Worcestershire and Staffordshire Electric Power Co. has received applications from the tenants of Corporation houses for the installation of heating and radio points, and it is suggested that the provision of these should be considered when the houses are being erected. The extra cost involved would be 6s. per point. Arrangements are being made for the provision of two additional points in future housing contracts where electric lighting is to be installed.

Dumfries.—JOINT GAS AND ELECTRICITY SHOWROOMS PROPOSED.—A proposal that the gas and electricity showrooms should be united as a measure of economy has been under discussion. There is keen opposition to amalgamation, and the proposal will be discussed further.

SODIUM STREET LIGHTING.—The Lighting Committee has asked the electrical engineer to prepare a scheme for the erection of sodium lamps, with an estimate of the cost.

Eastbourne.—SUPPLY TO FLATS.—At a cost of £891 the Electricity Committee is to provide a supply to flats in Staveley Road.

Eccles.—MAINS AND PLANT.—The Electricity Committee is to extend its mains and plant at a cost of £9,218.

CHANGE-OVER.—A change-over is to be effected on the Barton Hall Park and Edison Road housing estates at a cost of £4,680.

Hull.—LOAN.—Permission is being sought by the Electricity Committee to borrow £150,000 for mains and services.

ELECTRIC COOKING.—The Municipal Restaurant Committee is to install two electric ovens and hot-plates at the municipal kitchen at a cost of £164.

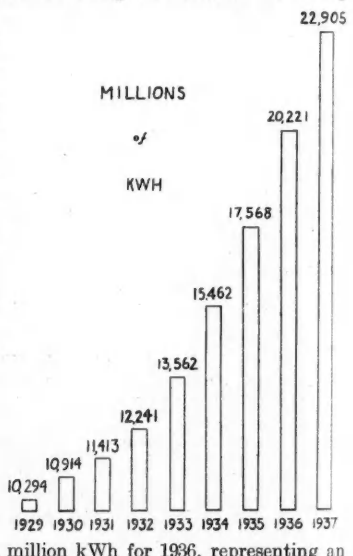
Inverness.—POWER PLANT.—Another attempt is being made to secure permission to install a 2,000-kW turbo-generator at the power station in Inverness by a deputation consisting of Provost Mackenzie, Mr. J. Cameron (town clerk), and Mr. C. G. Maclean (electrical engineer and manager) in consultation with Sir Murdoch Macdonald, M.P. for Inverness. Some time ago the application of the Town Council was rejected by the Electricity Commissioners, it being suggested that a bulk supply should be taken from the Grampian Electricity Supply Co.

Manchester.—CABLES AND SWITCHGEAR.—The Public Health Committee proposes to spend £650 on new cable and switchgear at Crumpsall Institution.

SANATORIUM INSTALLATION.—The Health Committee reports that the electrical installation at Baguley Sanatorium is in need of complete overhaul. The total cost of the work is estimated at £3,500.

Generation of Electricity

THE official returns rendered to the Electricity Commissioners show that 2,500 million kWh of electricity was generated by authorised undertakings in Great Britain during December, 1937, as compared with the revised figure of 2,180 million kWh in the corresponding month of 1936, representing an increase of 320 million kWh, or 14.7 per cent. The number of working days in the month (*i.e.*, excluding Sundays and Bank Holidays) was 25, the same as last year.



Diagrammatic comparison of the output of authorised undertakings in recent years

During 1937 the total amount of electricity generated by authorised undertakings was 22,905 million kWh, as compared with the revised figure of 20,221 million kWh for 1936, representing an increase of 2,684 million kWh, or 13.3 per cent.

The smallest increase last year was in February (6.6 per cent.), for which the fact that 1936 was Leap Year is to some extent accountable. The succeeding month had the largest expansion (18.3 per cent.), closely followed by June (18.1 per cent.), when the Coronation illuminations added to the consumption. The base-line of the diagram is 10,000 million kWh.

Nantwich.—SUPPLY TO BICKERTON.—The Council has been advised that the North Wales Power Co. intends to include a scheme for a supply of electricity to Bickerton in its 1938 programme.

Nelson.—FEEDER.—Representatives of the Nelson Electricity Committee are meeting Barnoldswick and Earby representatives to consider the provision of a duplicate feeder to Barnoldswick and Earby.

Plymouth.—STREET LIGHTING.—The Electricity Committee is to improve the street lighting at a cost of £2,210.

Southend-on-Sea.—CURTAILED ILLUMINATIONS.—Only half the usual amount is to be spent by the Town Council on sea-front illuminations for 1938. The display, which will be for five weeks instead of two months, will cost £5,000.

South Shields.—NO ILLUMINATIONS.—The Town Council has decided to reject the proposal of the Parks Committee to spend £5,000 on illuminations this year. It was pointed out that the Corporation had lost £2,500 on illuminations during the past five years, and it was agreed to abandon the scheme altogether.

SUB-STATIONS.—The North-Eastern Electric Supply Co., Ltd., is to erect sub-stations in Marsden Road and on the Horsley Hill estate.

Sprowston (Norwich).—STREET LIGHTING.—Street lighting in this fast-growing suburb of Norwich was recently discussed by the St. Faith's and Aylsham R.D.C. A suggestion that lamps should be placed on all roads and not only the main ones was made, and the clerk reported that it was proposed that a sub-committee should inspect the lighting system in Hellesdon and Sprowston.

Torquay.—HEATING AND VENTILATING.—Dr. Oscar Faber has been engaged by the Corporation to collaborate with the borough engineer in regard to a new system of heating and ventilation for the pavilion.

METER TESTING.—The Electricity Committee is to erect a meter-testing department at Newton Abbot at a cost of £15,000.

Wakefield.—LOANS.—Sanction is being sought by the Electricity Committee to borrow £10,000 for sub-station switchgear and £10,000 for consumers' apparatus for hire.

Walsall.—SUB-STATION.—The sub-station at the Brockhurst sewage works is to be modernised at a cost of £500.

Weymouth.—ELECTRICITY CHEAPER.—The Electricity Department announces the following reductions in charges for electricity from the December quarter (1937) meter readings: Domestic, 25 per cent. reduction in fixed charges; "unit" rate, ½d. Business, 10 per cent. reduction in fixed charge, and "unit" rate reduced from 1¼d. to ¾d.

Wolverhampton.—ADDITIONAL EQUIPMENT.—The Electricity Committee is to provide additional feeders and sub-stations at a cost of £48,343. The Committee is also seeking sanction to borrow £25,000 for transformers and switchgear.

EXTENSIONS.—Mains extensions are to be carried out by the Electricity Committee in Oxley at a cost of £885 and to Lapley (£354). A supply is also to be provided to the Pendeford aerodrome (£228).

Traction

Brighton.—RESULT OF POLL.—A poll of the ratepayers on the Transport Bill which the Corporation is promoting in Parliament has resulted in 12,784 votes for the Bill and 1,355 against.

Italy.—FUTURE ELECTRIFICATION.—In addition to the Milan-Bologna-Ancona and Rome-Leghorn main lines, conversion work on which is now in its early stages, it has been decided to begin in 1940 the electrification of the Turin-Milan-Venice line. Conversion work on the Milan-Chiasso and Milan-Domodossola lines is being deferred until that year.

London.—NOISE-REDUCING SCREENS.—Last week the London Passenger Transport Board placed an order for the erection of noise-reducing screens in 5½ miles of tunnel between Golder's Green and Camden Town. The amount of this contract is approximately £15,000. The screens will consist of asbestos sheets, behind which a special noise-absorbing material will be packed. Scientific tests have shown that these screens, together with welded rails and the use of a perfected rail-grinding car, reduce train noise by 60 per cent.

TROLLEY-BUSES IN CENTRAL AREA.—The first trolley-bus services in Central London will come into operation in March, it is reported. The new vehicles will run on the present No. 21 (North Finchley to Holborn) and No. 17 (Highgate to Farringdon Road) tram routes and will be numbered 621 and 617, respectively. From Gray's Inn Road the No. 621 route trolley-buses will proceed *via* Holborn and Charterhouse Street to Farringdon Road to continue on route No. 617, and *vice versa*.

TRANSPORT IN NORTH SURREY.—The report of the London and Home Counties Traffic Advisory Committee for 1936-37 refers to a request for additional and improved travelling facilities in North Surrey by the Carshalton, Epsom and Ewell, Malden and Coombe, Mitcham, Sutton and Cheam, Banstead, and Merton and Morden local authorities. With regard to a suggested extension of the Northern tube railway to Epsom, with larger trains and longer platforms, a branch line to serve the eastern part of Mitcham and neighbourhood, and the provision of a new "non-stop" line to Kennington to relieve existing heavy traffic, it is stated that the London Passenger Transport Board has come to the conclusion that the prospective population to be served and prospective traffic to be carried are wholly inadequate to justify the cost of the scheme. Proposing greater use of the Southern Railway as one means of relieving the position in North Surrey, the Committee says that passenger loadings suggest that a large proportion of the public would rather put up with the inconvenience of having to stand in a crowded tube train which takes them to their destination without having to change than travel on the main-line railway and change at, say, Waterloo, London Bridge or Wimbledon.

Sunderland.—RETENTION OF TRAMS RECOMMENDED.—A report presented to the Town Council by Mr. C. A. Hopkins, general manager of the Corporation's transport undertaking, strongly recommends the Council to continue the tramways for some

Canadian Hydro-electric Progress in 1937

DETAILS of hydro-electric progress in Canada during 1937, issued by the Minister of Mines and Resources, Ottawa, show that a renewal of construction is taking place throughout the Dominion. Mining and other industrial activities have created a growing demand for power, as indicated by the monthly figures of output of central electric stations compiled by the Dominion Bureau of Statistics. Each month in 1937 has shown a substantial increase over the corresponding month in 1936, and for the ten-month period January-October, 1937, an aggregate increase of more than 9 per cent. over 1936 is reported. This growth in the power demand has effected a substantial reduction of the reserves of installed generating capacity which have existed in certain parts of the country as a result of the construction programme initiated prior to 1930. The industry is now directing its attention to the need for extending existing plants or undertaking new developments to meet the increasing requirements of industrial and domestic users.

New water-power installations in 1937 reached a net capacity of 167,161 h.p., bringing the total for the Dominion at the end of last year to 8,112,751 h.p. The increase was distributed by provinces as follows: British Columbia, 1,050 h.p.; Saskatchewan, 19,000 h.p.; Manitoba, 12,500 h.p.; Ontario, 15,475 h.p.; Quebec, 116,366 h.p., and Nova Scotia, 2,770 h.p.

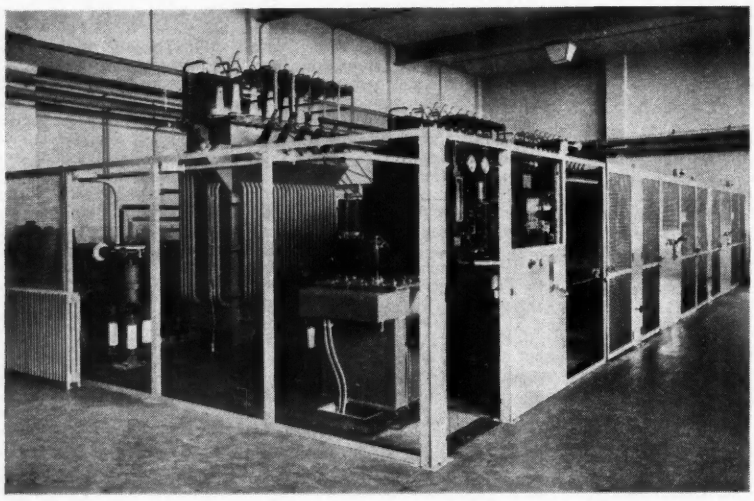
The British Columbia Power Corporation, Ltd., has decided to increase the facilities of its Ruskin power station on the Stave River by the addition of a second unit of 47,000 h.p., and the West Kootenay Power & Light Co., Ltd., has a major development under consideration on the Kootenay River, where 90,000 h.p. is contemplated. The City of Nelson is making tentative surveys to determine the extent of additions to its power plant to be carried out within the next two years. Field studies were continued by the Provincial Water Rights Branch of a project to divert the upper waters of the Nechako River by way of Eutsuk and Tahtsa lakes through the Coast Range to tidewater. Preliminary estimates indicate that more than 1,500,000 h.p. could be developed from this source.

In Ontario the Hydro-electric Power Commission experienced a steadily increasing demand in all its systems which necessitated the provision of new generating capacity. The construction of a 36,000-h.p. development at High Falls, on the Madawaska River, is projected. In the Georgian bay system the construction of a 10,000-h.p. generating station was commenced at Ragged Rapids, on the Musquash River. The construction of more than 1,900 miles of new rural circuits was approved by the Commission. In addition to the Commission's activities the Great Lakes Power Co. brought into operation a hydro-electric undertaking of 10,000 h.p. at Upper Falls, on the Montreal River, and a second development of 10,000 h.p. at Lower Falls is expected to be completed before the end of this year.

In Quebec the outstanding new development brought into operation was that of the Ontario Paper Co. at Outardes Falls with two units totalling 70,000 h.p. Extensions to existing plants included the addition of a twelfth unit of 45,000 h.p. to the Ile Maligne plant of the Saguenay Power Co. The Shawinigan Water & Power Co. proceeded with preliminary work on a projected new development at La Tuque, on the St. Maurice, which will have an initial installed capacity of 162,000 h.p. The City of Sherbrooke continued its preliminary work on a proposed 10,000-h.p. development at Two-Mile Falls, on the St. François River.

The Nova Scotia Power Commission, in October, commenced the construction of a 10,200-h.p. development at Cowie Falls, on the Mersey River, to increase the supply of power to the Mersey Paper Co.'s mill at Brooklyn. Electric service to rural communities was stimulated by the Rural Electrification Act passed by the Nova Scotia Legislature on June 1st last, under which provision is made for aid in the extension of electric power services to rural communities.

years to come, meanwhile building up such a reserve fund as will enable a new form of transport to be instituted without borrowing the capital needed. Since the tram system was reconstructed and modernised on his advice in 1929 (when Mr. Hopkins took control) the average yearly net profit has been £29,971. In the last four years the undertaking has contributed £25,000 to relief of local rates, and altogether the total amount contributed in relief of rates during the lifetime of the undertaking has been £105,000. The reserve fund of the trams now amounts to £30,000. If trolley-buses or motor-buses were substituted more vehicles would be required and operating costs per mile would be heavier. In the case of trolley-buses, Mr. Hopkins estimates there would be, after allowing for working costs and annual charges for sinking fund and interest on new capital expenditure, an annual loss of £22,384, and in the case of motor-buses an annual loss of £11,677. He considers that neither petrol- nor trolley-buses would relieve traffic congestion or increase public safety.



B.T.H. rectifiers at the Empire Broadcasting Station, Daventry

Communications

Great Britain.—RECTIFIERS AT DAVENTRY.—In the accompanying illustration are shown British Thomson-Houston 400-kW, 12,000/22,000-V rectifier equipments (with screens partly removed) at the Empire Station, Daventry, of the British Broadcasting Corporation. Five such equipments are installed, with space for a sixth. Normal voltage control is by induction regulators, but the equipments are also capable of giving grid control of voltage down to zero. The control grids are also used for high-speed arc suppression.

G.W.R. TELEGRAPH AND TELEPHONE SERVICES.—In a review of the operations of the Signal Department of the Great Western Railway during the past year it is mentioned that the north-easterly blizzard which occurred on February 27th last was particularly severe between Carmarthen and Aberystwyth and between Borth and Aberdovey, necessitating the provision of over a hundred new telegraph poles and 800 miles of new wire to make good the damage. The telephone work in connection with the superintendent of the line's new offices included the provision of a fifty-line inter-communication automatic switchboard and additional equipment at the automatic exchange at Old Oak Common. Progress was also made with the new telephone trunk line between Paddington and Birmingham and with the reorganisation of the circuits in connection with the Reading control. Improved telephonic facilities have also been provided between Westbury, Bristol and Swindon and also between Shrewsbury and Worcester.

Electrically Operated Sluices

THE new Allington sluices at the upper tidal limit of the Medway, two miles down stream from Maidstone, consist of three electrically operated vertically rising steel roller gates, two 30 ft. wide by 15 ft. deep, and one 16 ft. wide by 15 ft. deep, with provision for standby hand winding.

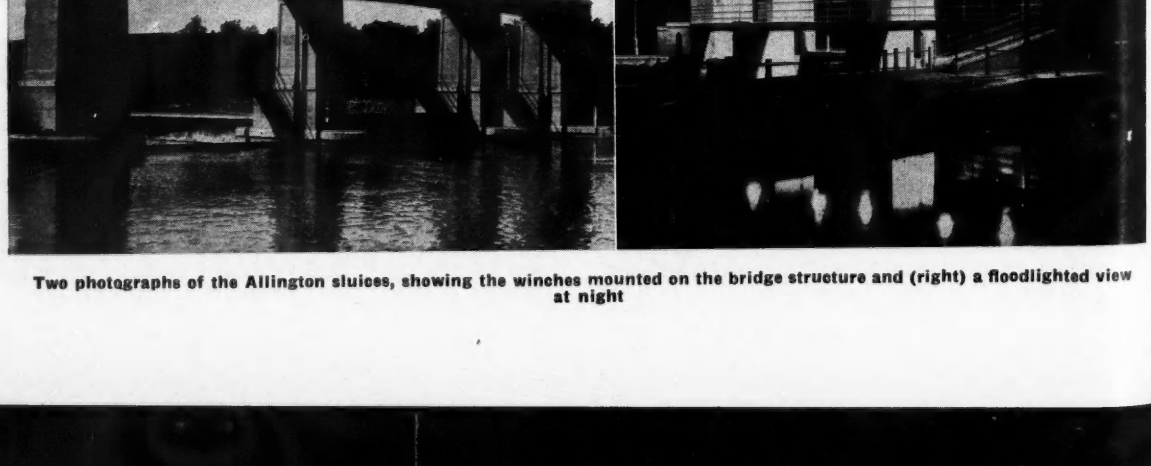
The construction of the new sluices is part of the Kent Rivers Catchment Board's programme to minimise flooding and improve navigation conditions in the upper Medway. The work is under the direction of the engineer to the Board, Mr. G. Cubley Crowther.

The small gate is controlled automatically by duplicate float mechanism to maintain constant level in the navigation pen above the sluice under normal flow conditions. The two large gates are for use as flood discharge openings when conditions of flood call for extra discharge capacity. These gates are remotely controlled from a lock keeper's cabin, and electrical indication equipment is provided in the cabin to show the position of opening of each gate. Water level recorders are installed in the navigation pen and in the main river below the sluice.

The counterweights of the gates are housed in concrete towers, and the winches and indicator transmitters mounted on a bridge structure across the towers. The gates may be lifted clear of the normal water level. A public footbridge with wide approach steps is also provided in the structure.

Electric floodlighting of the gates is provided for use on special occasions and in emergency, and general exterior and interior lighting is installed for the control room, access staircase and exterior winches. When down-river improvements are complete the sluices will be capable of discharging some three thousand million gallons per day under spring tide conditions without overflowing the channel above the sluices. This is estimated to reduce the flood level at Maidstone by two feet, and at Farleigh Lock, above Maidstone, by three feet six inches. The new discharge is double that of the original sluices. The total watershed drained to Allington sluices is 340,966 acres.

The main electrical contractors were E. A. Gardner & Sons, Ltd., Maidstone, the gate position indicators being supplied by the Lea Recorder Co., Ltd., the water level recorders by Electroflo Meters Co., Ltd., and the cables by Callender's Cable & Construction Co., Ltd.



Two photographs of the Allington sluices, showing the winches mounted on the bridge structure and (right) a floodlighted view at night

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Aberdeen.—January 17th. County Council. Education Committee. Electric lighting and heating at a school at Bankhead. G. Watt and Stewart, architects, 214, Union Street.

Australia.—MELBOURNE.—February 7th. City Council. Two 10,000-kVA transformers. (T. 31982/37.)*

February 16th. Melbourne & Metropolitan Tramways Board. One 500-kW rotary convertor, one 550-kV transformer, current limiter and spares. (T.Y. 32023/37.)*

February 16th. State Rivers and Water Supply Commission. One 1,100-kW alternator and switchgear and one 600-h.p. motor starter and switchboard. (T.Y. 32222/37.)*

February 1st. Deputy Director Posts and Telegraphs. Switches. (T. 32200/37.)*

Blackpool.—January 24th. Corporation. Stores, materials, &c., for one year. (January 7th.)

January 22nd. Corporation. One electrically driven drum-type screen and accessories for Manchester Square pumping station. Borough engineer, Municipal Offices, Talbot Square (deposit £1).

Bristol.—January 31st. Electricity Department. 6.6-kV and 11-kV e.h.v. switchgear. L.v. sub-station switchgear. (See this issue.)

Cheadle and Gatley.—January 17th. U.D.C. Electricity Department. 6.6-kV switchgear and 500-kVA oil-cooled transformer with manually operated off-load tap changer. (December 31st.)

Chesterfield.—January 15th. Electricity Committee. Supply of six miles of various cables. (January 7th.)

Cowdenbeath.—January 22nd. Town Council. Electrical work at public shelter, &c. Town clerk.

Dalkeith.—January 24th. Town Council. Electrical work at block of twelve three-apartment houses and shop at Back Street. Morham & Brotchie, 29, Hanover Street, Edinburgh.

Darlington.—January 17th. Borough Council. Electrically driven centrifugal sludge pumps, dual screen raking gear, electrically driven sludge evacuator for rectangular sedimentation tanks and revolving sewage distributors. Borough surveyor, Town Hall.

Dartford.—January 22nd. Borough Council. Meter testing equipment. (December 31st.)

East Ham.—January 20th. Electricity Undertaking. Six sets of 11,000-V switchgear. Four d.c. traction feeder switchboard panels equipped for trolley-bus operation. (January 7th.)

Erith.—February 7th. Electricity Department. Stores for twelve months. (See this issue.)

Hastings.—January 27th. Electricity Department. Stores for one and two years. (January 7th.)

Heston and Isleworth.—January 29th. Electricity Department. Kiosk, switchgear and transformer. Stores for one year. (See this issue.)

Horsham.—January 25th. R.D.C. Two electrically driven 5,000 gal. per hr. booster pump sets, complete with all electrical equipment. Clerk to the Council, North Street (deposit £2 2s.).

Hull.—January 18th. Electricity Department. Twelve months' supply of electrical stores. (January 7th.)

Ilford.—January 15th. Electricity Department. One three-phase and four single-phase meter-testing equipments, one d.c. battery control board and six d.c. meter-testing equipments. (January 7th.)

Irish Free State.—DUBLIN.—January 25th. Electricity Supply Board. Twelve months' supply of p.i. cables. (December 31st.)

KILKENNY.—January 17th. Board of Health. Two electric lifts for the New Central Hospital. J. N. Downes, architect, 53, Fitzwilliam Square, Dublin.

Kettering.—February 1st. Electricity Department. One polyphase meter-testing set. (January 7th.)

Kirkcaldy.—February 7th. Electricity Department. Fixed fire fighting plant and protective work for generating station. (See this issue.)

Kirriemuir.—January 28th. Town Council. Electric lighting installations in 35 houses. Lowe & Barrie, Bank Street (deposit £1 1s.).

Leeds.—January 17th. Housing Committee. Electric wiring of houses, cottage flats, shops and garages on various sites. R. A. H. Livett, housing director, 26, Great George Street (deposit £2).

Liverpool.—January 21st. Corporation. Electrical supplies for twelve months. (December 31st.)

London.—BETHNAL GREEN.—January 28th. Borough Council. Stores. (January 7th.)

HACKNEY.—January 26th. Electricity Department. Stores for one year. (January 7th.)

ISLINGTON.—January 26th. Electricity Department. Cookers, water heaters and wash boilers for one year. (January 7th.)

HAMMERSMITH.—January 26th. Borough Council. Electrical supplies for twelve months. (January 7th.)

BATTERSEA.—February 9th. Borough Council. Stores and materials for one year. (See this issue.)

Newcastle-on-Tyne.—City Council. Installation of electric lighting in 312 houses, Blakelaw estate. City architect, 18, Cloth Market.

New Zealand.—WELLINGTON.—Post and Telegraph Department. February 14th. Cable. (T. 31840/37.)*

March 15th. Public Works Supplies and Tenders Committee. Six 5,500-kVA, single-phase transformers and accessories. (T. 32329/37.)*

February 22nd. Public Works Department. Three 25-kVA transformers for Arapuni. (T.Y. 32332/37.)*

March 1st. Insulators. (T.Y. 32335/37.)*

February 25th. Cable. (T. 31756/37.)*

Northern Ireland.—BELFAST.—January 21st. Electricity Department. Stores for twelve months. (January 7th.)

Nuneaton.—January 31st. Corporation. D.c. and a.c. meter-testing equipment and instruments. (December 31st.)

Portland.—January 19th. U.D.C. Installation of electric light and heating at the new fire station in course of erection at Easton. R. Davison, Council Offices.

Preston.—January 29th. Corporation. Two 3½-ton electric level luffing portal quay cranes for Albert Edward Dock. Town Clerk, Municipal Building.

South Africa.—PORT ELIZABETH.—February 24th. Municipality. One 12,500-kW steam turbo-generator, with air and oil coolers; condenser; circulating, air and condensate pumps; pipes, valves and steelwork. (T. 31387/37.)*

DURBAN.—January 21st. General Stores Department. Cadmium-copper trolley wire. (T. 32041/37.)*

UMTATA.—March 24th. Municipality. Two 200-kW, three-phase alternators, direct-coupled to heavy oil engines, 3,300-V switchgear, accessories, &c. (T. 16020/38.)*

PRETORIA.—February 10th. Union Tenders and Supplies Board. Two motor generator sets. (T.Y. 16017/38.)*

February 17th. One 250-V, d.c. electric copying machine. (T. 16016/38.)*

Seaton Valley.—U.D.C. Electric wiring at 160 houses on the Blyth Street estate, Seaton Delaval.

Southend-on-Sea.—February 3rd. Electricity Department. Stores for one year. (See this issue.)

Stoke-on-Trent.—February 1st. North-West Midlands J.E.A. Electric kettles and irons. (See this issue.)

Swansea.—February 1st. Electricity Department. Stores for twelve months. (See this issue.)

Torquay.—February 4th. Corporation. Electric lamps, &c., for twelve months. Town clerk.

West Ham.—March 4th. Electrical installation at Whipps Cross Hospital, E.11. (January 7th.)

Wolverhampton.—February 8th. West Midlands J.E.A. Two-ton electrically operated goods and passenger lift at the Ironbridge power station. Chief engineer and manager, Phœnix Buildings, Dudley Road (deposit £1 1s.).

February 15th. E.h.v., h.v. and l.v. a.c. cables and l.v. d.c. cables for the Ironbridge generating station. (See this issue.)

* Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Barrow-in-Furness. — Electricity Committee. Accepted. Single-phase and three-phase meter-testing equipment (£825) and sub-standard rotating meter (£32).—Met.-Vick. Elecl. Co. D.c. meter-testing equipment (£65).—Fuller & Sons. Voltmeter (£55).—Weston Instrument Co. Potentiometer and accessories (£148).—Cambridge Instrument Co. Time standard (£19).—Venner Time Switches.

Blackpool.—Estates Committee. Accepted. Electrical installation at New St. John's Market.—G. D. Lax.

Heath Committee. Accepted. Reconditioning electrical installation at the abattoirs.—Ramsden Bros.

Bradford.—Education Committee. Accepted. Electrical installation at Highfield school (£206).—J. Carter & Son.

Watch Committee. Accepted. Traffic signals in King's Road (£596).—Automatic Telephone & Electric Co.

Electricity Committee. Accepted. One 33-kV and two 6.6-kV earthing resistances for the Valley Road power station, and three 6.6-kV earthing resistances for the Dudley Hill, Four Lane Ends and Odsal sub-stations.—G.E.C.

Bridlington.—Electricity Committee. Accepted. H.v. and l.v. cables for a new underground feeder from the electricity works to Marton Road (£1,816, including a provisional sum of £200).—Callender's.

Chesterfield.—Electricity Committee. Accepted. Rectifier (£187).—Electric Construction Co.

Durham.—County Education Committee. Accepted. Electrical work at the Blaydon Secondary School.—Falconar, Cross & Co.

Folkestone.—Town Council. Accepted. Wiring of twenty-six houses at Risborough Lane (£273).—J. J. Clayson & Son.

Gravesend.—Electricity Committee. Accepted. Kiosk and switchgear (£306).—Yorkshire Switchgear Co.

Hull.—Telephones Committee. Accepted. Cadmium copper wire (£407).—F. Smith & Co. Cable (£222).—Power & Lighting Cables.

Keighley.—Electricity Committee. Accepted. Arc rectifier (£664).—G.E.C.

Leeds.—Gas Committee. Accepted. Installation of emergency electrical plant at gas works (£3,446).—Ashworth & Parker.

Electricity Committee. Accepted. Cables.—Henley's (£348); Crompton Parkinson (£2,304); Edison Swan Cables (£1,730); Enfield Cables (£3,314); B.I. Cables (£310); Telegraph Construction and Maintenance Co. (£1,400); Connollys (Blackley) (£998); Hackbridge Cable Co. (£688).

London.—L.C.C.—Electrical installations in blocks of dwellings at Poynders Garden Estate, Wandsworth :

	£		£
Colaby & Co. Accepted ...	**3,723**	Samuel Reed & Sons	4,462
Buchanan and Curwen	3,820	Francis Polden & Co.	4,515
Holliday & Son (Electrical) ...	3,926	City Electrical Co.	4,576
Archibald Meckhonik	4,180	Read and Partners	5,130
Carr Brothers	4,348	Alexander Hawkins & Sons ...	5,315
Jacob, White & Co.	4,391	Springvale Electrical Co. ...	5,365
Pinching and Walton	4,419	John Hunter & Co.	6,078

Wiring and fittings for electric lighting, power and radio systems at the St. Marylebone Institution :

	£		£
Berkeley Electrical Engineering Co. Accepted	**4,466**	Pinching and Walton	5,536
W. J. Furse & Co. (London) ...	4,720	City Electrical Co.	5,776
H. J. Cash & Co.	5,090	F. H. Wheeler & Co.	5,820
Atozed (London)	5,183	Samuel Reed & Sons	5,945
		Alexander Hawkins & Sons ...	6,175

Electrical installation at Kingwood Road School:

	£		£
Holliday & Son (Electrical).		G. E. Taylor & Co.	1,512
Accepted	**1,289**	Jacob White & Co.	1,538
Buchanan and Curwen	1,398	Anderson, Angell & Co.	1,558
Samuel Reed & Sons	1,402	Francis Polden & Co.	1,608
E. and C. Champion	1,431	Atozed (London)	1,982
A. Dean & Co., Westminster ...	1,456		

Manchester.—Electricity Committee. Accepted. Fan motors for twelve months.—S. Hodgson & Co. (Halifax); G.E.C.; Keith, Blackman.

Education Committee. Accepted. Electrical installations in schools.—Peacock Street, R. Seddon & Sons (Manchester); Moston Fields, John Collier & Co. (Electrical Engineers); Princess Road and Yew Tree, S. H. Heywood & Co.

Rotherham.—Transport Committee. Accepted. Switchgear (£330).—Whipp & Bourne.

Sleaford.—Electricity Committee. Accepted for twelve months. L.v., p.i. cables.—Callender's. Meters.—Switchgear & Meters; Aron Electricity Meter; Measurement, Ltd.; Met.-Vick. Elecl. Co.

Southport.—Building Schemes Committee. Recommended. Electrical work at the new police headquarters and fire station (£5,979).—A. A. Sudlow & Co.

Forthcoming Events

Institution of Electrical Engineers.—Thursday, January 20th. Institution, London, W.C.2. 6 p.m. "The Design of Domestic Electric Cookers." Mr. O. W. Humphreys. "Electric Cookers for Domestic Purposes, with special reference to Maintenance Costs." Mr. J. N. Waite.

Transmission Section.—Wednesday, January 19th. Institution, London, W.C.2. 6 p.m. "Current Rating of Cables for Transmission and Distribution." (E.R.A. Report.) Messrs. S. Whitehead and E. E. Hutchings. "Current Rating and Impedance of Cables in Buildings and Ships." (E.R.A. Report.) Messrs. H. C. Booth, S. Whitehead and E. E. Hutchings.

Western Centre.—Monday, January 17th. Royal Hotel, Cardiff. 6.30 p.m. Annual dinner and dance.

North Midland Centre.—Tuesday, January 18th. Hotel Metropole, Leeds. 7 p.m. General discussion on "Electrical Engineering Education." Introductory papers by Professor C. L. Fortescue, Col. H. C. Fraser, and Mr. F. H. Clough.

North-Western Centre.—Tuesday, January 18th. Midland Hotel, Manchester. 6.45 p.m. Annual dinner.

East Midland Sub-Centre.—Tuesday, January 18th. College of Technology, Leicester. 6.45 p.m. "The 154,000 h.p. Galloway Hydro-Electric Scheme." Mr. P. W. Seewer.

Northern Ireland Sub-Centre.—Tuesday, January 18th. 9, Wellington Place, Belfast. 6.30 p.m. "Safeguards against Interruptions of Supply." Messrs. H. W. Clothier, B. H. Leeson, and H. Leyburn.

Sheffield Sub-Centre.—Wednesday, January 19th. Royal Victoria Hotel, Sheffield. 7.30 p.m. "Layout and Rupturing Capacity of Protective Devices in Motor Circuits." Mr. J. O. Knowles.

Irish Centre.—Thursday, January 20th. Trinity College, Dublin. 6 p.m. "Safeguards against Interruptions of Supply." Messrs. H. W. Clothier, B. H. Leeson and H. Leyburn.

E.I.B.A. (*Nottingham Branch*).—Friday, January 14th. Palais de Danse, Nottingham. Annual supper and dance.

Association of Supervising Electrical Engineers.—Tuesday, January 18th. 2, Savoy Hill, London, W.C.2. 7.15 p.m. "The Equipment of Large High-Voltage Transforming Stations." Mr. J. R. Kennedy.

Junior Institution of Engineers.—Friday, January 21st. Institution, London, S.W.1. 7.30 p.m. Informal meeting. Discussion on "Power Station Efficiencies," to be opened by Mr. R. H. Parsons.

Notes

The E.I.B.A.

Mr. H. S. Fothergill, secretary of the Electrical Industries Benevolent Association, informs us that Mr. F. W. Clements, who has just retired from the chairmanship of the State Electricity Commission of Victoria, has purchased one of the celebrated Ferranti cable joints for presentation to the Technical College in Melbourne. Thus the coffers of the E.I.B.A. are enriched by £25, and Australian youth will have a tangible reminder of a great electrical pioneer.

The annual meeting of the Yorkshire Area Committee of the Electrical Industries Benevolent Association will be held on February 1st at the Hotel Metropole, Leeds, at 6.15 p.m. under the chairmanship of Mr. W. B. Woodhouse.

Prevention of Meter Thefts

Vigorous efforts by the South Shields Corporation Electricity Department to stop meter thefts are proving successful, and fraudulent extraction of current, which at one time meant an annual loss of between £5,000 and £10,000, has been to a large extent stopped. Repairs for damage done to meters have cost nearly £300 a year. A recent innovation has been the appointment of surprise examiners who visit houses to inspect meters without previous warning, but with 21,000 meters under its care the Department finds it an almost impossible task constantly to supervise all.

Canet Memorial Lecture

Sir William H. Bragg has accepted the invitation of the Council of the Junior Institution of Engineers to deliver the Eighth Quadrennial Canet Memorial Lecture. The meeting will be held on May 5th at the Royal Institution.

Engineering and the Public

An outline of the preliminary work of the Engineering Public Relations Committee, which was formed early last year for the purpose of making better known to the public the services carried out by engineers, was given by Lord Stonehaven on January 6th at a luncheon held at the Savoy Hotel, London, to mark the inauguration of the Committee's activities. Fourteen institutions and other bodies, including the Institution of Electrical Engineers, have each appointed a member to the Committee. Sir Clement Hindley, vice-president of the Institution of Civil Engineers, has been elected chairman for 1937-38. An Executive Committee set up under the chairmanship of the public relations officer and secretary, Lt.-Col. F. H. Budden, has already organised a series of lectures illustrated by films and lantern slides for schools and colleges, and in this connection has produced an attractive brochure entitled "Engineering, What It Is and What It Does," which briefly traces the evolution of engineering. Exhibits are to be prepared illustrating various branches of engineering to be shown first in London and then circulated to provincial centres. Co-operation with the general and technical Press, the British Broadcasting Corporation, and the film companies is aimed at by providing an organisation to which reference can be made for information concerning items of engineering interest. It is hoped that in due course institutions and engineering societies outside London will co-operate with the Committee, of which they will be entitled to become affiliated members. Further information regarding the aims and objects of the Committee may be obtained from the Public Relations Officer, Engineering Public Relations Committee, 1-7, Great George Street, Westminster, S.W.1.

N.E. Coast Engineers and Shipbuilders

On Tuesday last a meeting of the North-East Coast Institution of Engineers and Shipbuilders was held in Sunderland to inaugurate the Sunderland Branch of the Institution. The chairman of the Branch is Major R. N. Thompson, and the hon. secretary is Mr. A. J. Marr.

1938 Centenaries

Commenting in *Nature* on scientific centenaries in 1938, Engineer Captain Edgar C. Smith mentions Karl Selim Lemström (1838-1904), of Helsingfors, who made researches into atmospheric electricity and the effects of electricity on plants and whose work was very fully reported in the pages of this journal. Major-General Charles Webber (1838-1904) was an officer of the Royal Engineers and an expert in telegraphy, who assisted the Post Office to organise its telegraph department, and in 1871 was associated with the foundation of the Society of Telegraph Engineers, now the Institution of Electrical Engineers. There was also Carl Louis Schwendler (1838-82), an electrical engineer of German nationality, who worked many years with the telegraph department of India.

E.A.W. Notes

Tributes to the remarkable growth of the Association and its activities in connection with the training of demonstrators, the homeworkers' campaign and kitchen planning were paid at the annual dinner of the Stoke-on-Trent Branch held on January 6th. Alderman H. Leese congratulated Mr. C. H. Yeaman, the city electrical engineer, on his achievements in unifying the local services.

Sir Montague Hughman, chairman of W. T. Henley's Telegraph Works Co., Ltd., has presented the Association with a William IV cup in silver, to be called "The Lady Hughman Challenge Bowl," which will be held by the winner of a golfing competition among members of the E.A.W.

The Association is to participate in the Domestic Services Exhibition and Conference which is to be held from January 15th to 21st at the Royal and New Horticultural Hall, Westminster. On Tuesday, Miss Dorothy Vaughan, E.A.W. housecraft lecturer, will speak on the uses of electricity in the home.

Appointments Vacant

Electrical engineer for the Trinidad Electricity Board.

Lady showroom assistant for Stoke Newington Council.

Combustion engineer for Southampton Electricity Department.

Sales and consumers' engineer and female cooking demonstrator and lecturer for Newport (Mon.) Electricity Department.

Assistant telephone traffic superintendent, G.P.O.

Personal technical assistant to the electrical engineer (generation) of the London Passenger Transport Board.

Full-time lecturer in electrical engineering at Wolverhampton and Staffordshire Technical College.

Chief assistant engineer for Douglas (I. of M.) electricity undertaking.

(See our Classified Advertisements.)

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

DUOPHANE lighting fittings.

Readers should enclose stamped addressed envelopes when making their inquiries.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. G. G. Jobbins has been appointed chairman of the State Electricity Commission of Victoria, and took over the office at the end of December last. He was formerly general manager of the Commission's Electricity Supply Department which controls the retail distribution of electricity in the metropolitan area and country districts. According to the *Electrical Engineer and Merchandiser*, he has been associated with the electricity supply business in Victoria since he began his career. His apprenticeship was served with the A. V. Alcock Electric Light & Motive Power Co., Ltd., and he later became a member of the staff of the Electric Lighting & Traction Co. of Australia, Ltd. He rose to the position of manager of the last-named company, and when its assets were taken over by the Electricity Commission he was appointed metropolitan manager.

Mr. H. W. Millatt, sales and installation engineer to the Newport (Mon) Corporation Electricity Department, has been appointed sales and consumers' engineer to the Scarborough Corporation Electricity Department.

Mr. T. G. Frost, A.M.I.E.E., of Chamberlain & Hookham, Ltd., is now in charge of the London area consequent on the death of Mr. A. V. Bland.

Mr. E. W. Marchant, B.Eng., A.M.I.E.E., who since 1933 has been on the technical staff of the North-East England district of the Central Electricity Board, has recently joined the sales staff of Chamberlain & Hookham, Ltd. Mr. Marchant was previously with Highfield & Roger Smith, consulting engineers, in London and Birmingham. He took up his duties at the beginning of this year in the London area.

Monsieur C. M. J. Galatoire-Malegarie, managing director to the Compagnie Parisienne de Distribution d'Électricité, has recently been appointed a Commander of the French Legion of Honour.

Mr. W. H. Massom, who has been with the North-Eastern Electric Supply Co., Ltd., for twenty-six years at the company's Cold Hesledon distribution station, has retired and has been presented with a silver watch.

Following the retirement of **Mr. J. Lingard,** chief assistant engineer, Electricity Department, the Edinburgh Corporation decided, on January 6th, that the position of chief assistant engineer should be abolished, and that a deputy engineer and manager should be appointed. It was further agreed that **Mr. J. Eccles,** senior technical assistant, should be appointed deputy engineer and manager.

Mr. B. Jones has been appointed assistant engineer in the Southampton Corporation Electricity Department. Mr. Jones served his apprenticeship with the Merthyr Electric Traction Co., and later held positions at Cardiff and Fulham.

Co-operation between gas and electricity is not impossible: this photograph shows Mr. C. H. Smith, President of the Institution of Gas Engineers, with Sir George Lee, President of the I.E.E., at the Engineering Public Relations Committee luncheon **(see page 70)**

Mr. C. MacKechnie Jarvis, A.M.I.E.E., has joined the Electrical Department of W. H. Allen, Sons & Co., Ltd., of Bedford. He received his technical training at the Battersea Polytechnic, where for a short period he subsequently acted as part-time lecturer. Later he joined the Electrical Apparatus Co., in London, and was in charge of the Technical Department before going to represent the company in Yorkshire, Nottinghamshire and Derbyshire. He left the company in July last, and for a time was with Allen West & Co., at Brighton.

Mr. A. F. Roger has been appointed a director of Telephone Properties, Ltd.

Mr. A. Parker, of Oldham, has been appointed to the position of charge engineer at the Stuart Street power station of the Manchester Corporation.

Mr. R. J. Welsh has relinquished his position as general sales manager of Petters, Ltd., and has joined the staff of the English Electric Co., Ltd., as chief sales engineer of that company's Diesel Engine Department. Mr. Welsh is a Whitworth Exhibitioner, with practical knowledge of steam, electrical and internal-combustion engineering on land, sea and air. He is an associate member of the Institutions of Mechanical and Marine Engineers.

Mr. N. Boydell, A.M.I.E.E., was recently promoted by the Eastbourne Corporation to the position of chief assistant borough electrical engineer in succession to Mr. L. A. Gripper, who has been appointed borough electrical engineer at Beckenham. Mr. Boydell commenced his engineering career with Sutcliffe & Speakman at Leigh, Lancs, and later received his electricity supply training under Mr. J. B. Hudson at the Leigh undertaking. In 1925 he was appointed to the position of third mains assistant at Southport, later being promoted to second assistant mains engineer. He was appointed district engineer with the Bedford Corporation electricity undertaking in 1929, in which position he was responsible for considerable development work in connection with the rural demonstration scheme of the Electricity Commissioners. In 1932 he was appointed to the position of assistant mains superintendent at Blackburn, from which position he was later appointed mains engineer with the Eastbourne Corporation about four years ago.

Mr. N. Boydell

The death of Monsieur Paul Janet, for many years director of both the Laboratoire Central d'Électricité and the Ecole Supérieure d'Électricité, Paris, which are run under the ægis of the Société Française des Electriciens, has resulted in various changes in the management of the two institutions of both of which **Monsieur R. de Valbreuze** has been appointed general director. **Monsieur Raymond Jouaust** has been elected director of the Laboratoire Centrale and **Monsieur Jean Fallon** Professor of General Electrotechnics of the Ecole Supérieure.

Obituary

Mr. A. J. Ward.—We regret to announce the death of Mr. Arthur J. Ward, which occurred at his home, "Dunluce," Fulwood Road, Sheffield, on January 8th. Mr. Ward was assistant managing director of Thos. W. Ward, Ltd., Sheffield, and had been connected with the company for fifty-six years. Commencing his career as an office boy with a firm of accountants in Norfolk Street, he left after two years' service and joined his two brothers in the firm which the elder had founded several years previously. For a time he was connected with the ivory horn handle and stag hook, and silent machine departments, and when still in his 'teens travelled for orders in connection with these both in London and on the Continent. Later he was made a partner in the firm, and when this was formed into a limited liability company some years later he became assistant managing director. Mr. Ward had served on the Sheffield City Council and was chairman of the Electricity Committee for a period.

Mr. T. W. Green.—The death occurred on December 31st of Mr. T. W. Green, traffic inspector with the Heywood Corporation Passenger Transport Department. Mr. Green, who had spent thirty-nine years in passenger transport service, joined the Blackpool & Fleetwood Tramroad Co. in the "'nineties," and subsequently held positions at Liverpool, St. Helens and Bury.

Mr. A. Forster, who died recently at Norton-on-Tees, was formerly tramways manager with the Stockton Corporation, retiring in 1932. In 1898, when trams were introduced on Tees-side, Mr. Forster was works superintendent at the Stockton depôt, and in 1921 he became tramways manager.

Mr. G. Wade.—The death occurred on January 1st, in his seventy-fifth year, of Mr. George Wade, Sen., chairman of George Wade & Son, Ltd.

Will.—Mr. G. S. Peckham, late of G. S. Peckham & Co., electrical wholesale distributors, left £41,793, with net personalty £41,732.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

W. T. Rawcliffe & Son, Ltd.—Private company. Registered December 28th. Capital, £100. Objects: To carry on the business of manufacturers' agents for electrical goods and materials of all kinds, &c. The directors are: W. T. Rawcliffe, "Glengarth," Outwood Road, Heald Green, Ches; and N. Rawcliffe, 15, Hilbre Road, Burnage, Manchester. Secretary: A. C. Chapman.

Newage (Manchester), Ltd.—Private company. Registered December 24th. Capital, £100. Objects: To carry on the business of electric light, power and radio engineers, &c. The subscribers are: C. W. Hunt and J. W. Hurst, both of 42, King Street West, Manchester. Registered office: 38, King Street West, Manchester.

Scottish Western Radio Services, Ltd.—Private company. Registered December 21st. Capital, £100. Objects: To carry on the sale by hire purchase or deferred payments of all kinds of radio goods, radio appliances, radio-gramophones, gramophones, &c. The directors are: M. L. Roxburghe, 13, Ruthven Street, Hillhead, Glasgow, W.2; and J. C. Walker, 37, Clova Street, Carnwadric, Glasgow. Registered office: 49, Bath Street, Glasgow.

Liverpool Radio Supplies, Ltd.—Private company. Registered December 24th. Capital, £500. Objects: To carry on the business of radio distributors, manufacturers of all types of radio and electrical equipment, including talking picture and television equipment, &c. The directors are: J. Evans and Mrs. J. I. Evans, both of 35, Rudston Road, Childwall, Liverpool. Registered office: 64, Myrtle Street, Liverpool.

K-Radio, Ltd.—Private company. Registered December 28th. Capital, £1,000. Objects: To carry on the business of merchants of and dealers in all kinds of radio, electrical and telephone appliances, &c. The directors are: T. B. Stuttard, 12, Hargreaves Street, Burnley; and E. Moulds, 11, Nicholas Street, Burnley. Registered office: 59, Abbey Street, Accrington.

George Lister, Gloucester (1937), Ltd.—Private company. Registered December 31st. Capital, £750. Objects: To acquire the business of an electrical and mechanical engineer and contractor, merchant and dealer in electrical machinery and appliances, electrical fittings, manufacturer of and dealer in wool-oiling machines, &c., carried on at Dursley by Geo. Lister. The directors are: G. Lister, Broadway Cottage, Dursley; N. P. Newman, The Halt, Amberley, near Nailsworth; and G. Lister, jnr., 20, Clarence Street, Gloucester. Registered office: 20, Clarence Street, Gloucester.

Jackson's Radio, Ltd.—Private company. Registered December 24th. Capital, £1,000. Objects: To carry on the business of manufacturers, importers and exporters of, agents for and dealers in radio, photographic and cinema apparatus, &c. The directors are: A. Fogelman and H. Fogelman, both of 79, Old Kent Road, S.E. Registered office: 79, Old Kent Road, S.E.

A. T. Barratt & Co. (Manchester), Ltd.—Private company. Registered January 1st. Capital, £2,000. Objects: To carry on the business of electrical, radio and mechanical engineers, contractors and merchants, dealers in radio and television apparatus, service engineers for all classes of neon signs and lamps, &c. The permanent directors are: A. T. Barratt (chairman), 6, Brentbridge Road, Fallowfield, Manchester; and H. Seabright, 11, Tottington Street, Clayton, Manchester, 11. Registered office: 1, Fennel Street, Manchester, 4.

R. & H. Nelson, Ltd.—Private company. Registered in Edinburgh on December 30th. Capital, £100. Objects: To carry on the business of electrical, mechanical, radio, telephone, lighting, heating, motor and general engineers, &c. The directors are: R. Nelson, 33, Belvedere Road, Bellshill; and D. H. Nelson, 19, Beechwood Gardens, Calder Road, Mossend. Registered office: 245, Main Street, Bellshill.

Alpha Accessories, Ltd.—Private company. Registered January 5th. Nominal capital, £18,000. Objects: To carry on the business of manufacturers of and dealers in electrical equipment of every description, &c. The subscribers are: W. H. Harper, 73, Newman Street, W.1, Alpha & Omega Trust, Ltd., 22, Aldermanbury, E.C., and Ulysses, Ltd., 199, Piccadilly, W.1. Registered office: 22, Aldermanbury, E.C.2.

S. Hohly & Co., Ltd.—Private company. Registered December 30th. Capital, £100. Objects: To carry on the business of makers of and dealers in electrical and/or chemical appliances and goods of all kinds, &c. The directors are: F. Barnett, 13, Pollux Gate, Fairhaven, Lytham, St. Annes-on-Sea, and Miss G. Burns, Frystonlea, Kitts Moss Lane, Bramhall, Ches. Registered office: 12a, North Lodge Road, Branksome, Bournemouth.

Wilkes Radio (Urmston), Ltd.—Private company. Registered January 8th. Capital, £1,500. Objects: To carry on the business of electrical, radio and mechanical engineers, dealers in radio, electrical and mechanical apparatus, accessories and components, &c. The directors are: D. E. Wilkes, 22, Barton Road, Urmston, Lancs, and W. B. Thomas, 6, Highfield Road, Monton, Eccles, Lancs. Registered office: 1, Fennel Street, Manchester.

Featherston (Engineers), Ltd.—Private company. Registered January 8th. Capital, £1,000. Objects: To carry on the business of mechanical and electrical engineers, &c. The directors are: C. Featherston and Mrs. A. P. Featherston, both of 20, Finsbury Park Road, N.4, and H. Mason. 220, Eastern Avenue, Ilford. Registered office: 366, Goswell Road, E.C.1.

A. G. Brooker, Ltd.—Private company. Registered January 8th. Capital, £100. Objects: To carry on the business of manufacturers of, agents for and dealers in radio and television sets, accessories and apparatus, electrical fittings, &c. The directors are: A. G. Brooker and Mrs. A. G. Brooker, both of 23, High Street, Slough.

Southern Electrical Services, Ltd.—Private company. Registered January 1st. Capital, £1,000. Objects: To carry on the business of electricians, electrical contractors and engineers, dealers in electrical plant, &c. The directors are: H. D. Tanner, Kenmaree, Ayling Lane, Aldershot, and R. J. Corner, 15, Courtlands Avenue, S.W.16. Registered office: 151, Victoria Road, Aldershot.

General Radio Equipment, Ltd.—Private company. Registered in Edinburgh January 4th. Capital, £100. Objects: To carry on the business of manufacturers and suppliers of electrical apparatus, batteries, sound amplifiers, gramophones or other sound instruments, &c. The directors are: B. C. Groom, The Hollies, Galashiels, and T. C. Wilson, St. Andrews, Hamilton Drive, Bothwell. Registered office: 112, Cadzow Street, Hamilton, Lanarkshire.

Hammond & King, Ltd.—Private company. Registered January 3rd. Capital, £3,000. Objects: To carry on the business of manufacturers and repairers of and dealers in electrical fittings, appliances, apparatus, supplies and goods of every description used in the electrical trade and capable of consuming electricity, &c. The permanent joint directors are: J. W. Hammond, 32, Moore Road, Mapperley, Nottingham, and T. H. King, 121, Haydon Road, Sherwood, Nottingham. Registered office: Tokenhouse Yard, Bridlesmith Gate, Nottingham.

Neon (Signs & Metalcraft), Ltd.—Private company. Registered January 3rd. Capital, £2,000. Objects: To carry on the business of wholesale or retail manufacturers, hirers, repairers, storers, warehousers and merchants of and dealers in electric signs, lamps and fuses, enamel service signs, advertising signs, neon electric and daylight signs, electric motors, dynamos, accumulators and electric and metal goods of all kinds, &c. The first directors are: T. J. Fox (chairman) and others to be appointed by him. Solicitor: J. R. C. Miller, Portland Place, Portsmouth.

W. & A. Electrical Equipment Distributors, Ltd.—Private company. Registered January 3rd. Capital, £500. Objects: To carry on the business of general distributors, manufacturers, wholesalers, retailers and factors of and agents for all types of electric signs, radio and television sets, and gramophones, electric lamps, clocks, refrigerators, &c. The permanent directors are: B. J. Wainwright, 2, Hillcrest, Dollis Hill Lane, Neasden, N.W.2, and H. Album, 84, Greencroft Gardens, N.W.6. Registered office: Evelyn House, 62, Oxford Street, W.1.

Victoria Electrical Co. (Manchester), Ltd.—Private company. Registered January 4th. Capital, £1,000. Objects: To carry on the business of manufacturers and repairers of, agents for and dealers in vacuum cleaners, electrical accumulators, batteries, acids and containers, dynamos, &c. The directors are: W. N. Hollinsworth, 89, Clough Avenue, Sale, and C. Ogden, 4, Moorfield Road, Swinton.

Wilsons' Radio, Ltd.—Private company. Registered January 5th. Capital, £500. Objects: To carry on the business of manufacturers, repairers and hirers of and dealers in electrical and mechanical apparatus, accessories and components, and in particular radio sets and valves, gramophones, radio-gramophones, &c. The first directors are: J. R. Wilson and Mrs. F. M. Wilson, both of 115, Wolverhampton Road, Stafford. Registered office: 115, Wolverhampton Road, Stafford.

Amberton Electric, Ltd.—Private company. Registered January 4th. Capital, £5,000. Objects: To carry on the business of electrical, radio, mechanical and general engineers and engineering contractors, consulting wireless experts, &c. The directors are: R. Amberton (permanent director and chairman), and A. R. Amberton, both of Heyday, Chertsey, Surrey. Secretary: W. O. Jackson, 32, Queen Victoria Street, E.C.4.

Returns of Electrical Companies

Gambrell Radio Communications, Ltd.—Second debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated December 16th, 1937, to secure £74,250 and any other sums which may be or become due or owing by the company to the holders of any account, and ranking *pari passu* with second debenture dated December 10th, 1937. Holders: Leadenhall Securities Corporation, Ltd., 145, Leadenhall Street, E.C.

Radioptics, Ltd.—Capital, £1,000 in £1 shares. Return dated November 26th, 1937. 702 shares taken up. £2 paid. £700 considered as paid. Mortgages and charges, nil.

Holophane, Ltd.—Capital, £100,000 in £1 shares. Return dated October 12th, 1937. All shares taken up. £7 paid. £99,993 considered as paid. Mortgages and charges, nil.

W. R. Sykes Interlocking Signal Co., Ltd.—Capital, £37,550 19s. in 46,173 "A" shares of 10s. and 41,327 "A" shares of 7s. Return dated September 30th, 1937. 41,327 "A" 7s. shares taken up. £7,656 12s. paid (3s. 6d. per share on 41,327 shares of 7s., plus £424 7s. 6d. paid on 970 "A" shares of 10s. forfeited). £7,232 4s. 6d. considered as paid (3s. 6d. per share on 41,327 "A" shares of 7s.). Mortgages and charges, nil.

Mullard Wireless Service Co., Ltd.—Capital, £10,100 in 10,000 "A" and 100 "B" shares of £1. Return dated November 9th, 1937. All shares taken up. £9,300 paid on 9,200 "A" and 100 "B" shares. £800 considered as paid on 800 "A" shares. Mortgages and charges, nil.

Dean & Noble, Ltd.—Capital, £1,000 in £1 shares. Return dated September 13th, 1937. All shares taken up. £1,000 considered as paid. Mortgages and charges, nil.

Ellis & Ward, Ltd.—Capital, £10,000 in 2,000 preference and 8,000 ordinary shares of £1. Return dated November 17th, 1937. 1,000 preference and 6,003 ordinary shares taken up. £1,003 paid on 1,000 preference and 3 ordinary shares. £6,000 considered as paid on 6,000 ordinary shares. Mortgages and charges, nil.

Warren Brothers (Middlesbrough), Ltd.—Capital, £20,000 in 16,000 ordinary and 4,000 deferred shares of £1. Return dated September 28th, 1937. 8,030 ordinary and 4,000 deferred shares taken up. £7,904 paid on 7,904 ordinary shares. £4,126 considered as paid on 126 ordinary and 4,000 deferred shares. Mortgages and charges, £1,000.

Ricardo & Co. Engineers (1927), Ltd.—Capital, £21,000 in 20,000 shares of £1 and 20,000 shares of 1s. Return dated November 12th, 1937. All shares taken up. £2 paid. £20,998 considered as paid. Mortgages and charges, nil.

General Radio (Eastville), Ltd.—Miss Molly G. Walker, of 8, Jacobs Wells Road, Bristol, was appointed receiver and manager on December 8th, 1937, under powers contained in debenture dated November 27th, 1937. (Notice filed January 5th, 1938.)

Forest Battery Service, Ltd.—G. Ross, of 31, Queen Street, Cardiff, ceased to act as receiver and manager on December 15th, 1937.

Radenite Batteries, Ltd.—Capital, £20,000 in £1 shares. Return dated November 24th, 1937. 6,754 shares taken up. £4,654 paid. £2,100 considered as paid. Mortgages and charges, nil.

Venus Radio & Electrical Co., Ltd.—Capital, £1,000 in £1 shares. Return dated July 15th (filed December 16th), 1937. All shares taken up. £1,000 paid. Mortgages and charges, nil.

Watliff Co., Ltd.—Capital, £15,000 in 3,000 ordinary, 7,000 7½ per cent. preference and 5,000 6 per cent. preference shares of £1. Return dated August 24th, 1937. 3,000 ordinary and 12,000 preference shares taken up. £14,880 paid. £120 considered as paid. Mortgages and charges, £4,500.

Challis Transformers, Ltd.—A. E. Limehouse, of 24, Market Place, Rugby, ceased to act as receiver and/or manager on December 30th, 1937.

Spence (Contracting), Ltd.—F. C. Pulley, of Finsbury Court, Finsbury Pavement, E.C., was appointed receiver on December 23rd, 1937, under powers contained in debenture dated August 26th, 1933.

Milford-on-Sea Electric Supply Co., Ltd.—The nominal capital has been increased by the addition of £5,000 in £1 ordinary shares beyond the registered capital of £25,000. At April 6th, 1937, the Bournemouth and Poole Electricity Supply Co., Ltd., held 11,180 shares out of 12,000 issued.

Weald Electricity Supply Co., Ltd.—Satisfaction in full on May 27th, 1932, of series of debentures authorised by resolution dated December 15th, 1926, and registered January 17th, 1927, securing £100,000. (Notice filed December 30th, 1937.)

General Accessories Co., Ltd.—Satisfaction in full on August 31st, 1937, of mortgage to Lloyds Bank, Ltd., dated July 8th, 1924, and registered July 11th, 1924, securing all moneys due or to become due from the company to the bank not exceeding £3,000. (Notice filed December 24th, 1937.)

Bamford Works, Ltd.—Sir Leonard J. Coates, of 2, East Parade, Leeds, was appointed receiver and manager on December 30th, 1937, under powers contained in debenture dated July 15th, 1932.

Transformers & Welders, Ltd.—Particulars filed of £14,000 debentures, authorised December 13th, 1937, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Leach Electrical and Engineering Co., Ltd.—Debenture charged on the company's property, present and future, including uncalled capital, dated December 22nd, 1937, to secure £1,500. Holder: H. A. Dormer, 11, Queen Victoria Street, E.C.

Union Radio Co., Ltd.—Capital, £5,000 in £1 shares (1,500 ordinary and 3,500 preference). Return dated November 17th, 1937. 1,285 ordinary and 3,200 preference shares taken up. £4,485 paid. Mortgages and charges, £2,202.

Townlea Electrical Co., Ltd.—Capital, £1,000 in £1 shares (300 preference and 700 ordinary). Return dated December 28th, 1937. 500 shares taken up. £500 paid. Mortgages and charges, nil.

City Notes

The Westinghouse Brake & Signal Co., in a preliminary statement reports a net profit for the year ended September 30th of £275,632, as compared with £260,765 in the preceding year. The ordinary dividend for the year is maintained at 10 per cent., but the cash bonus is raised by 2½ per cent. to 7½ per cent. General reserve receives £75,000, and staff pensions £10,000. The directors have reduced the book value of goodwill to £1 by writing off £31,993. The balance carried forward is £70,569 (against £60,060 brought in).

International Combustion, Ltd., reports profits (including subsidiaries) of £181,655 for the year ended September 30th. After providing for directors' fees (£4,000) and placing £20,000 to tax and N.D.C. reserve, there is a net profit of £157,655 (against £164,050), to which is added £24,733 brought in. The final ordinary dividend is 12½ per cent., making 20 per cent. (same), plus a bonus of 10 per cent. (same), and £17,878 is carried forward.

Ensign Lamps, Ltd., has declared an interim dividend of 10 per cent., less tax, on the ordinary shares. The company was made public in April last and for the six months to June 30th, 1937, paid a dividend of 10 per cent., less tax.

Newman Industries has declared a final dividend of 3 per cent., plus a further 2 per cent., on the 6 per cent. cumulative preferred ordinary shares, making 8 per cent. for the year.

The Electrolytic Zinc Co. of Australasia is paying an interim dividend of 6 per cent. on the ordinary shares (same).

Thorn Electrical Industries has announced the half-year's dividend on the preference shares.

The Urban Electric Supply Co., Ltd., proposes to reduce its capital from £1,050,000 to £525,000 by repaying 15s. of each of the 700,000 £1 ordinary shares. The company will also pay a bonus of 30s. per reduced ordinary share from undivided profits. Edmundsons Electricity Corporation, Ltd., holds 680,167 of the shares. In a circular to shareholders the company states that during the year the electricity undertakings of the following companies have been transferred to the Cornwall Electric Power Co.: Redruth & Illogan, East Cornwall, Launceston, Truro, Penzance, West Cornwall, Camborne, Callington, Liskeard, and Newquay. In addition, the company's Newbury undertaking has been transferred to the Wessex Electricity Co. The company's shareholdings in the Cornwall Electric Power Co. and the East Anglian Electric Supply Co., Ltd., have been sold on favourable terms. The result of these transfers and sale of investments is that a large part of the capital is no longer required, and it is proposed, therefore, to write down and pay off part of the ordinary capital. After the reduction the capital will be increased to its present amount of £1,050,000 by the creation of 2,100,000 5s. ordinary shares. Meetings to consider the proposals will be held on January 26th.

Edmundsons Electricity Corporation, Ltd.—In order to meet the capital needs of expanding business, the directors are issuing 750,000 £1 ordinary shares at 30s. per share. The offer is to ordinary stockholders, who are being given the right to take up the shares in the proportion of one for each £5 ordinary stock held. The new shares will be converted into stock when fully paid, and will receive a dividend of 2¾d. per share in respect of the current year ending March 31st (equal to 9 per cent. per annum, the same rate as that paid on the ordinary stock last year). Thereafter the shares will be in all respects identical with the existing ordinary stock. By the present offer the issued ordinary capital is being raised from £3,750,000 to £4,500,000. The company reports that the results of the operations of its group of companies during December as compared with the corresponding month of 1936, show an increase of 16 per cent. in kWh sold.

Central London Electricity, Ltd., formerly the Charing Cross Electricity Supply Co., Ltd., has placed privately £500,000 3¼ per cent. debenture stock. Of this amount about £300,000 is for the redemption of debenture stocks of three constituent companies and the balance is for financing the development of certain properties in London which have hitherto been financed by temporary loans. The amalgamation of the six operating companies controlled by London Associated Electricity Undertakings, Ltd., is recorded in our "Business Notes" section.

Ismay Industries, Ltd., announces that it has purchased the business of A. C. Cossor, Ltd. Meetings of Ismay Industries will be convened in the near future to increase the authorised capital, and full information will then be given. The new issue of shares, foreshadowed at the annual meeting in August last, consists of 50,000 5½ per cent. cumulative first preference shares of £1 each and 552,000 ordinary 5s. shares. These shares, the remainder of the first preference and ordinary capital, are offered to existing shareholders at par.

R. B. Pullin & Co., Ltd., in their first report for the year to October 31st, report a trading profit of £31,700, less depreciation £2,128, leaving £29,572. The offer for sale of March 2nd showed a profit of £19,826 for 1935-36. The company was registered in February last. After providing for directors' fees, income tax, N.D.C., and writing off goodwill, there is a balance of £15,569. A dividend of 15 per cent. is paid and £5,069 is carried forward.

Companies to be Struck Off the Register.—The names of the following companies will be struck off the Register at the expiration of three months from January 7th unless cause is shown to the contrary:—Electric Light, Power & Hiring Co., Ltd.; Euphonic Radio & Elecl. Co., Ltd.; National Radio Co., Ltd.; United Electric & Glass Industries, Ltd.; Electramonic (Foreign Rights), Ltd.; "M.P.A." Wireless, Ltd.

Stocks and Shares

TUESDAY EVENING.

STOCK Exchange markets seem to be getting into better fettle, in spite of the gravity of the news from the Far East. Business in stocks and shares shows a disposition to expand and money is beginning to return to the more speculative departments. The claims of the tax collector are making no difference, at present, to the strength exhibited by gilt-edged securities. A brighter tone has come over the American market, owing to the President's announcement of an extended armament programme in the United States, in addition to which some of the principal employers of labour have just reinstated a good many thousands of men who had previously been "put off." Base metals are showing considerable strength. A rise in the price of rubber, to over 7d. per pound, came as a sequel to the increased activity in the American motor-car trade.

Edmundsons New Shares

Edmundsons Electricity Corporation ordinary shares at 36s. 6d. are quoted ex-rights to the issue of new shares at 30s. Shareholders are offered one new share for every five held. Rights were calculated as being worth approximately 1s. 3d. per share, so that the price of the old shares, previously standing at 38s., has fallen 9d. since the announcement of the issue. The new shares are changing hands at around 6s. premium over the issue price of 30s. The fact that these can be bought in the form of renounced allotment letters, free of stamp duty, makes them look a cheaper purchase than the old shares. For the remainder of the current year the former are promised a dividend at the rate of 9 per cent. From this it is generally assumed that the older capital will receive

a similar distribution; the same rate, that is to say, as last year's. On this basis, the new shares will pay rather over 5 per cent. on the money, a return well above the average run of yields on Home electricity supply issues. As a reason for this disparity the uncertainty which surrounds the position of holding companies under the coming legislation for the industry is suggested. The gap will narrow as soon as an end has been reached to the selling of "rights" by shareholders unwilling to take up their allotments.

Safety-first Stocks

Investment buying of safety-first issues continues to get the better of the supply, with the result that Government and other gilt-edged stocks again stand higher on the week. This upward movement has been accompanied by the usual talk of a Government loan in the offing. Market opinion believes, however, that the Treasury will be in no particular hurry to raise the next instalment for the national defence programme. There are no quotable alterations in the prices of Central Electricity Board issues. London Transport "A" stock, at 118½, has gained a point. Of interest to holders of the Board's "C" stock, in particular, was the statement that no further schemes of expansion are to be undertaken until after completion of the £40 million programme with which the Board, in conjunction with two of the main line companies, is now engaged. The price of the "C" stock has eased a little to 79½. Dealings began last week in the new Central London Electricity 3¼ per cent. debentures. The stock, which was placed privately at a price of 93, is changing hands at around 1¼ premium. Industrial debentures of the first class are scarce, but Kent Electric 3¼ per cents. can still be bought in fair quantity at 97, free of stamp duty. This is a point above the price of the recent issue: the yield is £3 12s. on the money. London Power 5 per cent. debenture has been marked up to 107, at which price the return is £4 13s. 6d. per cent.

Ismay Industries' Acquisition

News that Ismay Industries have purchased the A. C. Cossor undertaking puts the official stamp on rumours which have been circulating for some time. Speculation on the probability of some such development has lately had a stimulating effect on the price of Ismay Industries shares. On the announcement it further advanced to 6s. 6d., but profit-taking caused a reaction to 5s. 9d. Details of the deal are to be given at the meeting which will be called for the purpose of expanding the authorised capital. In the meantime, the balance of the authorised ordinary and preference shares is being offered at par to shareholders. The market expects a further issue to be made when the board has obtained the necessary powers. According to the company's circular, profits of 20 per cent. should be earned, under the new conditions, on the ordinary capital. For last year a dividend of 6 per cent. was paid, giving a yield at the present price of the shares of 5¼ per cent.

Price Movements

Electricity supply shares, deriving reflected strength from the firmness of gilt-edged prices, retain all their composure. In the electrical equipment market, General Electrics, at 77s. 6d., Associated Electricals, at 45s., and British Insulated, at 95s., have improved under investment demand. Lancashire Dynamos moved up to 3½, and Switchgear and Cowans to 19s. On optimistic expectations as to coming dividends, Westinghouse Brakes rose 1s. 6d. to 63s. 6d., and Consolidated Signals 1/6 to 5½. Among the weaker spots are Electric Constructions, at 1¾, and Chloride Electrical Storage, which are down by ¼, to 72s. 6d. Telegraph Condensers gave way to 18s. 9d., and Walsall Conduits to 24s.

American Affairs

Mr. Roosevelt's slightly more friendly attitude towards the American business community is partially responsible for Wall Street's turn for the better. While it has been possible to fix on little of definitely helpful nature in the President's latest speeches, much store is set by his more conciliatory tone. It still remains to be seen whether this will be translated into something sufficiently practical to set in motion again the wheels of capital enterprise. In the meantime, Wall Street has seized upon the American re-armament programme, and the better labour conditions—mentioned in our first paragraph—as convenient levers for putting up prices with a run. American Telephone and Telegraph shares are 2 dollars higher. Curiously enough, the sterling stocks of the Anglo-American Telegraph Company are lower. Marconi Marines have hardened to 30s.

Miscellaneous Matters

Brazilian Tractions fell heavily on account of sales made by holders to whom continuance of cash dividend payments by the company looks now to be improbable. From 13, the price dropped to 10, then recovered to 11. With the outlook so obscure as it is for the service of Brazilian loan interest, it is felt that the position of the Traction Company is equally uncertain. The rally in price was due to bargain-hunting purchases. The Anglo-Argentine Tramways group is the centre of considerable speculative interest. The 5 p.c. debenture stock, after dipping to 23, picked up to 24½. The 4 p.c. debenture has hardened to 43½, the 4½ p.c. to 34½. Tokyo Electric six p.c. bonds are flat at 54. Home engineering companies' shares have advanced in a few cases, Babcocks, for instance, being 6d. better at 43s. 9d. Rubber shares are a very quiet market.

Share List of Electrical Companies

	Nom.	Dividend. Previous.	Last.	Price Jan. 11.	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	67/6	—	4 9 0
City of London	1	7½	7½	34/-	—	4 8 3
Clyde Valley	1	7	8	2	—	4 0 0
County of London	1	10½	10½	49/-	—	4 5 9
Edmundson's 7% Pref.	1	7	7	33/-	—	4 4 10
Do. Ord.	1	8	9	36/6xr.	—9d.	4 18 8
Elec. Dis. Yorkshire	1	9	9	41/6	—	4 6 10
Elec. Fin. and Securities	1	12½	12½	2⅝	—	4 15 3
Elec. Supply Corporation	1	11	12	52/-	—	4 12 5
Lancs Light and Power	1	7½	7½	33/-	—	4 11 0
Lond. Assoc. Electric	1	—	7	31/3	—	4 9 6
London Electric	1	7	8	35/6	—	4 10 2
London Power Deb. Red.	Stock	5	5	107	+½	4 13 6
Metropolitan	1	10	10	45/-	—	4 9 0
Midland Counties	1	7½	8	37/6	—	4 5 0
Mid. Elec. Power	1	8	9	2 1/16	—	4 7 4
North Eastern Electric Ordinary	1	6	7	32/-	—	4 7 6
Do. 7% Pref.	1	7	7	34/-	—	4 2 4
Northampton	1	10	10	45/-	—	4 9 2
Notting Hill 6% Pref.	10	6	6	14	—	4 5 9
North Met. Elec. Ordinary	1	10	10	47/6	—	4 4 2
Do. do. 6% Pref.	1	6	6	30/-	—	4 0 0
Scottish Power	1	8	8	37/-	—	4 6 6
South London	1	7	7	32/6	—	4 6 2
Whitehall Elec. Invst 7½% Pref.	1	7½	7½	21/6	—	6 19 6
Yorkshire Elec.	1	8	8	39/6	—	4 1 0
PUBLIC BOARDS.						
Central Electricity, 1950–70	Stock	5	5	113	—	4 8 6
Do. 1955–75	„	5	5	116	—	4 6 2
Do. 1951–73	„	4½	4½	109	—	4 2 7
Do. 1963–93	„	—	3½	98	—	3 11 5
London Elec. Trans. Gtd.	„	—	2½	90	—	2 15 7
London & Home Counties, 1955–75	„	4½	4½	110	—	4 1 10
London Passenger Transport, A	„	—	4½	118½	+1	3 16 3
Do. do. B	„	—	5	120½	—	4 3 0
Do. do. C	„	4	4½	79½	—½	5 7 0
West Midlands Joint Elec. 1948–68	„	—	5	112	—	4 9 3
TELEGRAPH AND TELEPHONE.						
American Tel. & Tel.	$160	9	9	147½	+2	6 2 0
Anglo-Am. Tel. Pref.	Stock	6	6	114½	—1	5 4 10
Do. Def.	„	1½	1½	28	—½	5 7 3
Cable & Wireless 5½% Pref.	„	4½	5½	103	—	5 6 10
Do. Ord.	„	—	—	66	—	—
Do. Income	„	—	—	101½	—	3 18 10
Globe Tel. & Tel. Ord.	10	4½*	5½*	15½	—	3 13 4
Do. do. Pref.	10	6	6	13⅜	—⅛	4 7 3
Great Northern Tel.	10	20	20	40½	+½	4 18 9
Marconi-Marine	1	10	7½	30/-	+1/16	5 0 0
Oriental Telephone Ord.	1	12*	12*	2⅞	—	4 3 6
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref.	5	Nil	Nil	7/6	—	—
Do. do. 2nd Pref.	5	Nil	Nil	4/6	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	24½	+1	—
British Electric Traction Def. Ord.	„	5	5	1037	+12	—
Do. do. Pref. Ord.	„	8	8	165	—	4 17 0
Brazil Traction	$100	70 cts.	$1	11	—1½	—
Brit. Columbia Elec. Rly. Pfd.	Stock	5	5	103½	—	4 14 9
Mexican Light Common	$100	Nil	Nil	2	—	—
Do. 1st Bonds	$500	5	5	35	—	—
Victoria Falls Ord.	1	20	12	3	—	4 0 0
West Riding	1	6½	10	2	—	5 0 0
MANUFACTURING COMPANIES.						
Aron Electricity Ord.	1	15	15	2	—	7 10 0
Assoc. Elec. Ord.	1	8	10	45/-	+6d.	4 9 0
Do. Pref.	1	8	8	38/-	—	4 4 6
Babcock & Wilcox	1	8	10	43/9	+6d.	4 11 6
British Aluminium Ord.	1	7½	10	47/-	+9d.	4 5 0
British Insulated Ord.	Stock	20	20	4⅜	+⅛	4 4 6
Brush Ord.	Stock	Nil	Nil	25⅛	—	—
Callender's	1	15	15	4 1/16	—	3 9 1
Do. 6½% Pref.	1	6½	6½	31/3	—	4 2 4
Crompton Parkinson Ord.	5/-	12½	12½	30/-	—	—
Do. 8% Pref.	1	8	8	37/6	—	4 5 4
Electric Construction	1	7	10	1⅜	—1/16	5 14 4
Enfield Cable Ord.	1	25	25	5⅛	—	4 17 8
English Electric	1	Nil	Nil	31/-	+1/-	—
Do. do. Pref.	1	6⅛	6⅛	25/6	—	5 2 0
Ericsson Tel.	5/-	20	25	2⅛	—	2 18 10
Ever Ready	5/-	35	45	26/-	—	8 13 2
Ferranti Pref.	1	7	7	27/6	—	5 1 10
G.E.C. Pref.	1	6½	6½	32/6	—	4 0 0
Do. Ord.	1	15	17½	77/6	—1/-	4 10 2
Henley's	5/-	30	15	18/9	—9d.	4 0 0
Do. 4½% Pref.	1	4½	4½	1⅛	—	4 0 0
India-Rubber Pref.	1	5½	5½	21/3	—	5 3 6
Johnson & Phillips	1	⅛	10	40/9	—6d.	4 18 0
Lancashire Dynamo	1	10	20	3½	+½	5 14 4
Siemens Ord.	1	6	7½	28/9	—	5 4 4
Telegraph Construction	£1	Nil	7½	2⅜	—	3 3 0

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1935

17152. "Prime-mover electric traction installations." Sir W. G. Armstrong Whitworth & Co. (Engineers), Ltd., D. J. Watkins, J. H. Abbink Spaink and D. C. Plyer. June 15th, 1936. (476929.)

1936

6414. "Radio direction-finding apparatus." F. J. Hooven. March 3rd, 1936. (Addition to 472111.) (Convention date not granted.) (476721.)

6483. "Electric signal transmission systems." M. Bowman Manifold and J. Collard. March 3rd, 1936. (Cognate application 4855/37.) (476799.)

7256. "Control systems for electrically operated winding and like mechanisms." British Thomson-Houston Co., Ltd., and H. W. C. Liddiard. March 10th, 1936. (476669.)

10335. "Indirectly heated thermionic cathodes." Radio-akt.-Ges. D. S. Loewe. April 10th, 1935. (476675.)

13036. "Electric cooking apparatus." R. H. Rogers. May 8th, 1936. (476677.)

13331. "Method, of, and cathode-ray apparatus for, transforming luminous energy into electrical wave energy." V. Zeitline, A. Zeitline and V. Kliatchko, May 9th, 1935. (476865.)

13403. "Protective means for electrical measuring instruments." H. S. Macadie and Automatic Coil Winder & Electrical Equipment Co., Ltd. May 12th, 1936. (476681.)

13404/5. "Electrical measuring instruments." H. S. Macadie and Automatic Coil Winder & Electrical Equipment Co., Ltd. May 12th, 1936. (476682/3.)

13406. "Multi-range electrical measuring instruments." H. S. Macadie and Automatic Coil Winder & Electrical Equipment Co., Ltd. May 12th, 1936. (476738.)

13722. "Gas or vapour filled electric-discharge vessels made of glass." Elin Akt.-Ges. für Elektrische Industrie. May 14th, 1935. (Cognate applications 13723/36 and 13724/36.) (476933.)

13795. "Television systems." A. D. Blumlein. May 15th, 1936. (476935.)

16164. "Electric insulators." Steatite & Porcelain Products, Ltd., and C. R. Lown. June 9th, 1936. (476687.)

16195. "Electrolytic condensers." Dubilier Condenser Co. (1925), Ltd. June 24th, 1935. (476688.)

16353. "Electric incandescent lamps and filaments therefor." W. Berger. June 11th, 1935. (476804.)

16397/8. "Conduits for electric cables." Power Centre Co., Ltd., and A. H. Stevens. June 12th, 1936. (476870/1.)

16481. "Electrical heating of forgings." G. D. M. Benedetto. June 12th, 1936. (476872.)

16549. "Liquid-insulated electric circuit-breakers." A. Reyrolle & Co., Ltd., and A. Allan. June 13th, 1936. (476742.)

16573. "Means of volume and tone control in audio-frequency amplifiers." O. B. Sneath. June 13th, 1936. (476877.)

16645. "Television systems." H. R. Lubcke. June 15th, 1936. (476808.)

16646. "Methods of electric welding." British Thomson-Houston Co., Ltd., and J. Donkin. June 15th, 1936. (476809.)

16661. "Electric signal apparatus, more particularly for telephones." H. De Csarada. June 15th, 1936. (476810.)

16662. "Electrical impedance networks." Siemens & Halske Akt.-Ges. June 14th, 1935. (476811.)

16669. "Telephone systems." Automatic Electric Co., Ltd. (in liquidation), and O. A. Pearce. June 15th, 1936. (476813.)

16687. "System of voice-frequency alternating-current signalling and impulsing." Panstwowe Zaklady Tele-Iradjotechniczne, Warszawie. June 15th, 1935. (476880.)

16728. "Electric vaporisers for therapeutic purposes." Levering Laboratories, Inc. September 27th, 1935. (476814.)

16782. "Piezo-electric crystals." Marconi's Wireless Telegraph Co., Ltd. June 29th, 1935. (476889.)

16799. "Electric fire-alarm apparatus." W. G. Owen. June 17th, 1936. (476891.)

16818. "Electron-discharge devices." Ferranti, Ltd., and J. C. Wilson. June 17th, 1936. (476815.)

16909. "Electron valves." Naamlooze Vennootschap Machinerieen-En Apparaten Fabrieken Meaf. June 19th, 1935. (476695.)

16979. "Magnetic deflecting means for electron-discharge devices." Baird Television, Ltd., L. R. Merdler and G. R. Tingley. June 18th, 1936. (476947.)

16980. "Television or like systems." Baird Television, Ltd., and P. W. Willans. June 18th, 1936. (476948.)

17005. "Electric circuit-breakers." C. H. Flurscheim, T. E. Allibone, W. G. C. Vance, E. R. Disbury and Metropolitan-Vickers Electrical Co., Ltd. June 18th, 1936. (477005.)

17006. "Electric circuit-breakers." C. H. Flurscheim, W. G. C. Vance, E. R. Disbury and Metropolitan-Vickers Electrical Co., Ltd. June 18th, 1936. (477006.)

17007. "Electric circuit-breakers." C. H. Flurscheim and Metropolitan-Vickers Electrical Co., Ltd. June 18th, 1936. (477007.)

17674. "Electron tubes." J. Pintsch Akt.-Ges. December 21st, 1935. (476817.)

17798. "High-frequency coils and transformers." Plessey Co., Ltd., and F. Kammer. June 26th, 1936. (476973.)

17970. "Ward-Leonard type electric ship-propulsion equipment." English Electric Co., Ltd., H. S. Carnegie and J. C. Wilson. June 29th, 1936. (476901.)

17976. "High-pressure metallic-vapour electric-discharge lamps." Siemens Electric Lamps & Supplies, Ltd., and J. N. Aldington. June 29th, 1936. (476818.)

19162. "Mounting of filaments of refractory metals." General Electric Co., Ltd., and S. M. Duke. July 10th, 1936. (476757.)

19163. "Thermionic valves and other electric-discharge devices." M-O Valve Co., Ltd., and R. Le Rossignol. July 10th, 1936. (476758.)

19528. "Radio communication systems." Telephone Manufacturing Co., Ltd., and L. H. Paddle. July 14th, 1936. (476701.)

19686. "Totally enclosed fan-cooled dynamo-electric machines." English Electric Co., Ltd., and E. A. Binney. July 15th, 1936. (476819.)

21301. "Liquid-blast electric circuit-breakers." British Thomson-Houston Co., Ltd. August 1st, 1935. (476821.)

24139. "Automatic voltage-regulating means." General Electric Co., Ltd., and H. H. Taylour. September 3rd, 1936. (476829.)

24236. "Construction of electrodes for cathode-ray tubes and the like." General Electric Co., Ltd., and M. Benjamin and R. O. Jenkins. September 4th, 1936. (Cognate application 31823/36.) (476830.)

24383. "Electric calculating apparatus embodying potentiometric elements." E. Granat and Compagnie des Forges et Acieries de la Marine et d'Homecourt. October 31st, 1935. (476831.)

25437. "High-pressure metal-vapour electric-discharge lamps." General Electric Co., Ltd., and V. J. Francis. September 18th, 1936. (476774.)

25630. "Cooling means for electric-discharge devices." General Electric Co., Ltd., and J. W. Ryde. September 21st, 1936. (476775.)

27018. "High-frequency oscillators." V. Poulsen and D. P. L. Grether. October 5th, 1935. (476906.)

27892. "Rewireable cartridge-type fuses." General Electric Co., Ltd., A. F. Searle and G. E. Taylor. October 14th, 1936. (476907.)

29763. "Thermionic electrodes." General Electric Co., Ltd. (Patent-Treuhand-Ges. für Elektrische Glühlampen.) November 2nd, 1936. (Addition to 451989.) (476908.)

30270. "Electric-discharge devices having an inner envelope and an outer jacket capped at one end." General Electric Co., Ltd. (Patent-Treuhand-Ges. für Elektrische Glühlampen.) November 6th, 1936. (476336.)

33060. "Methods of and means for hardening metal parts by means of the electric current." P. Mouravieff and B. Mester. December 2nd, 1936. (476910.)

34814. "Methods of scanning images in television systems." H. Browde. December 18th, 1936. (476714.)

1937

3307. "Electric generators." R. A. Erren. February 4th, 1937. (476716.)

3330. "Dry surface-contact rectifiers." British Thomson-Houston Co., Ltd. February 4th, 1936. (476846.)

3870. "Controlling device for electrical circuits." C. Heinrich. February 10th, 1936. (476912.)

6075. "Electric valve converting systems." British Thomson-Houston Co., Ltd. February 29th, 1936. (476914.)

6905. "Methods of screening thermionic amplifiers." Siemens and Halske Akt.-Ges. March 9th, 1936. (Cognate application 6906/37.) (476915.)

7717. "Impulse transmitters for telephone systems." Ronag Akt.-Ges. May 22nd, 1936. (476917.)

8200. "Electron-discharge devices." Standard Telephones and Cables, Ltd. July 16th, 1936. (476718.)

8878. "Photo-electric cells." F. B. Dehn (Zeiss Ikon Akt.-Ges.). March 25th, 1937. (476719.)

9664. "Carrier-wave modulator systems." Marconi's Wireless Telegraph Co., Ltd. April 3rd, 1936. (476722.)

12663. "Step-by-step electromagnetic switches." R. M. Erricker. May 4th, 1937. (476920.)

15988. "Sockets for tubular electric incandescent lamps and the like." General Electric Co., Ltd. June 26th, 1936. (476856.)

17240. "Methods of producing semi-conducting coatings for dry-plate rectifiers and light-sensitive cells." British Thomson-Houston Co., Ltd. June 20th, 1936. (476790.)

17722. "Printing-telegraph apparatus." Standard Telephones and Cables, Ltd. June 29th, 1936. (476922.)

17964. "Electric transformers." British Thomson-Houston Co., Ltd. June 27th, 1936. (Addition to 470145.) (476923.)

18686. "Electric transmission of intelligence." Allgemeine Elektricitäts-Ges. July 4th, 1936. (476792.)

18750. "Electromagnetic clutches." Igranic Electric Co., Ltd. July 6th, 1936. (476992.)

22101. "Four-wire systems for carrier-wave telephony." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. August 14th, 1936. (476925.)

22902. "Electric welding." British Thomson-Houston Co., Ltd. August 22nd, 1936. (476794.)

25294. "Connecting symmetrical and asymmetrical high-frequency circuits or circuit parts." C. Lorenz Akt.-Ges. September 26th, 1936. (476926.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from January 5th:—

Firco. No. 579489. Class 5. Wire.—The Firth Co., Ltd., Florence Mills, Egerton Street, Warrington, Lancs.

Geometrical design only. No. 580327. Class 8. Electrical condensers, wireless telegraphic and telephonic apparatus and parts thereof, and electrically operated testing and recording apparatus, &c.—Sydney S. Bird & Sons, Ltd., Cyldon Works, Cambridge Arterial Road, Enfield, Middlesex.

The Voice of the World (lettering and design). No. 580551. Class 8. Wireless receiving sets, radiograms, and radio loud speakers.—Ultra Electric, Ltd., Ultra Works, Western Avenue, Acton, W.3.

Aoba. No. 580207. Class 13. Fittings for use in connection with overhead transmission wires for the transmission of electricity from overhead wires to electrically propelled vehicles. No. 580210. Class 16. Electrical insulators made of porcelain or earthenware. No. 580211. Class 50. Insulating substances (electrical) of asbestos, mica, resin, oils or bitumen, and insulators made mainly of wood.—The Anti-Attrition Metal Co., Ltd., Glengall Works, Glengall Road, S.E.15.

Ampo-Lite. No. 579975. Class 13. Electric lighting and heating fittings made of ordinary metal.—Electricals, Ltd., 5, Eldon Place, Newcastle-on-Tyne.

S.P.C. (lettering and design). No. 574981. Class 50. Electrical insulating tapes made of fabric impregnated with bituminous compositions, &c.—The Ruberoid Co., Ltd., Lincoln House, 296-302, High Holborn, W.C.1.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—Cinema, King Street; James F. Donald (Aberdeen Cinemas, Ltd.), H.M. Theatre.

Barking.—Extensions to factory, for Alexandra Stone Co. (Barking), Ltd., River Road.

Barnsley.—Houses (144), Park House estate (£49,308); borough engineer. Cinema, Silver Street; Odeon Theatres, Ltd.

Barrow-in-Furness.—Houses (30), Black Butts Lane; J. Parkinson & Sons, Ltd. Houses (36), Brook Street; A. Ingham. Houses (72), Roose Street; Stephenson & Ross, Ltd.

Basingstoke.—Business premises, Winchester Street, for Montague Burton, Ltd., Leeds.

Beaumaris.—Houses (30), £12,240; W. Evans & Co., (Pentraeth), Ltd., builders, Pentraeth, Anglesey.

Birkenhead.—Tenements, Cleveland Street and Patten Street, and extensions to Laird Street bus depot; borough engineer.

Birmingham.—Airport building, Elmdon; Norman & Dawbarn, architects and engineers, 43, Grosvenor Place, London, S.W.1.

Blackpool.—Houses (17), Preston New Road; Ramsden Bros., Ltd. Shops and offices, Corporation Street, Market Street and West Street; H. H. Vickers & Son.

Bolton.—Houses (52), Crompton Fold estate; Park & Co. Houses (12), Farnborough Road; F. & H. Douglas. Houses (10), Seaton Road; J. Massey & Sons. Extension to foundry, Bark Street; Ryder Bros., Ltd. Extensions to isolation hospital; R. J. Tyson.

Bradford.—Extension to nurses' home, Royal Infirmary (£30,000), for Board of Governors; secretary. Thornton School (£50,000); Education Committee and trade contractors. Extensions to Swain House School; Education Committee.

Broadstairs.—Men's convalescent home, Joss Bay (£50,000), for the Hearts of Oak Benefit Society; G. Grey Wornum, architect, 39, Devonshire Street, London, W.1.

Cardiff.—Houses (500); city engineer. Houses (16), Whitaker Road; R. B. Fear. Clinic, Ely (£10,477); Davies & Davies. Clinic, Grangetown (£8,884); Watts & Webb.

Cardiganshire.—Additions, alterations and improvements to County school, Aberayron, for the County E.C.; Rhys Jones, county architect, Llandyssul.

Carlisle.—Houses (12), Croft Road; S. W. B. Jack.

Chelmsford.—Cinema, Tindal Square; H. Weston. Seven shops, Wood Street; C. H. Hodgins.

Cheltenham.—School buildings, Pate's Grammar School for Girls (£77,889), for Governors; A. C. Billings & Sons, Ltd., builders, 54, Winchcombe Street.

Chesterfield.—Houses (25), Duckmanton; Staveley Coal and Iron Co., Ltd., Staveley.

Clackmannan.—Houses (20), Tullibody, for C.C.; T. Frame & Son, architects, 43, Hill Street, Alloa.

Consett.—Houses (80), Dale Avenue; U.D.C. surveyor.

Darwen.—Extensions to factory, for R. W. Holden, Ltd. Extensions to premises, for B. Worsley, Ltd.

Dukinfield.—Extensions to works, for D. Adamson & Co., Ltd.

Dumbartonshire.—School, Kirkintilloch, for the County Council; county clerk, Dumbarton.

Dundee.—Ice rink for Dundee Angus Ice Rink Co., Ltd., Kingsway West (£35,000); W. M. Wilson, architect, 61, Meadowside.

Dunfermline.—Garage premises for Post Office (£10,000); W. Dale, builder, Aberdour Road.

Durham.—Alterations and additions to the Peases West, Middlestone Moor and West Stanley High Street schools, for the County E.C.; F. Willey, architect, 34, Old Elvet, Durham.

East Ham.—Houses (42), Vicarage Lane (£22,600); borough engineer.

Eccles.—Houses (38), Dartford Avenue; J. Chapman & Son, Ltd. Houses (158), Winton and Barton (£87,566); borough surveyor. Houses (158), Worsley estate (£87,566); borough engineer. Buildings, Barton airport; Airways, Ltd.

Edinburgh.—School, Ferry Road, Leith (£47,000); city architect.

Enfield.—Houses (60), Beverley Road; W. Goodchild & Co. Factory, Hertford Road, and flats, Gordon Way; Bowyer & Bowyer.

Eston (YORKSHIRE).—Houses (48), Grangetown; U.D.C. surveyor. Eight shops and houses; Lowfields estate; S. Buxton. Reconstruction of Hippodrome cinema, South Bank; A. Campbell.

Fife.—Buildings, to Cameron Hospital, Buckhaven (£93,000); Williamson & Hubbard, architects, Kirkcaldy.

Gateshead-on-Tyne.—School, Joicey Road; Davison, Eason & Harkness, builders, New Mills, Barrack Road, Newcastle-on-Tyne.

Harborne.—Technical block, Woodville Road, for Birmingham Royal Institution for the Blind; T. Lowe & Sons, Ltd., builders, 10, St. Agatha's Road, Birmingham.

Harrow Weald.—Cinema, with shops and flats; Marshall & Tweedy, architects, 9, New Cavendish Street, London, W.1.

Hatch End.—Cinema; Mr. Starkie, architect, Station Road, Harrow.

Hove.—Houses (30), the Knoll; T. R. Humble, borough surveyor.

Ireland. — (LIMERICK). — Extensions to mental hospital (£50,000); Sheahan & Clery, architects, 47, O'Connell Street.

Kettering.—School, Windmill Avenue (£42,166), for the E.C.

Lancaster.—Premises, Hare Runs estate, for Lancaster and District Co-operative Society.

Little Stanmore.—Cinema, Whitchurch Lane, for M. Fissett, Chessington Avenue, London, N.3.

Liverpool.—Extensions to Tramway depot (£20,183), Linacre Road, Litherland; W. A. Gale, Ltd., contractors, Linacre Road, Bootle.

Lostwithiel.—Houses (13), Bridgend; borough surveyor, Municipal Offices.

Maldon.—Houses (58), eight sites; W. Almond, R.D.C. surveyor, 6, Market Hill.

Maryport.—Two factories for the West Cumberland Industrial Development Co., Ltd.; Sir Alexander Gibb & Partners, engineers, Queen Anne's Lodge, Westminster, London, S.W.1.

Middlesbrough.—Extensions to works, E. Hind (South Bank), Ltd.

Newburn-on-Tyne.—School, Bell's Close; P. J. Stienlet & Son, architects, Saville Row, Newcastle-on-Tyne.

Newcastle (STAFFORDSHIRE).—Houses, Bradwell Hall Farm estate; 1933 Housing Society, Ltd., Essex House, Essex Street, London, W.C.2.

Newcastle-on-Tyne.—Extensions to the City Mental Hospital for the City Council (£180,000); city architect.

Newmarket.—Houses (27), King George Avenue site No. 2, Exning; W. H. Eley, U.D.C., surveyor, Godolphin House.

Nuneaton.—Rebuilding cinema, Camp Hill Road; G. E. & W. Wincott, Ltd., builders, Coton Road.

Oldbury.—Extensions to works, Popes Lane; Tube Products, Ltd.

Ossett.—Houses (31), Swithenbank estate; borough engineer.

Oswaldtwistle.—Houses (33), Fielding Lane; G. Walsh & Sons, Ltd., builders, John Street.

Plymouth.—Houses (18), Ashburnham Road; T. H. Mitchell, Ltd. Flats (36), Stonehouse High Street (£19,770); A. N. Coles, Ltd. Hoe development (£323,000); city engineer.

Redditch.—Houses (20), Jubilee Avenue; J. H. Hamblin. Houses (24), Studley Road; C. McWhirter. Factory, Windsor Road; Harris & Walford, Ltd.

Redhill.—Houses (44), near Union Road, for Beddington Estates, Ltd.

Rotherham.—Houses (16), Oaks Lane; A. Watson. Houses (27), Renishaw Avenue; O. Parkin. Extensions to Art school; Scott & Sons, architects, Norwich.

Shiremoor (NORTHUMBERLAND).—Pithead baths, Fenwick and Bates Pits; J. H. Forshaw, architect, Miners' Welfare Committee, Romney House, Marsham Street, London, S.W.1.

Southend-on-Sea.—School, Caulfield Road, Shoeburyness (£35,494); A. D. Jackson & Sons (Contractors), Ltd., Bournemouth Park Road, Southend-on-Sea.

Southport.—Police and fire stations (£110,158); Tysons (Contractors), Ltd. School, Meols Cop Road, Blowick; L. Barnish, architect, 58, Rodney Street, Liverpool, 1.

South Shields.—Houses (18), Northfield Road and Grosvenor Road; G. R. Smith & Partners, architects, Winchester Street.

Staffordshire.—Schools, Pleasey estate, Great Barr, near Walsall, for the E.C.; G. C. Lowbridge, County Offices, Stafford.

Stone.—Houses (36), Redhill Gardens; G. S. Challacombe, U.D.C. surveyor, Town Hall, Stone.

Stretford.—Houses (16), Cressingham Road; Grimshaw (Builders), Ltd.

Suffolk.—Schools, Felixstowe, Yoxford and Halesworth (£77,000), for the East Suffolk E.C.; county architect, Ipswich.

Sunderland.—Café and food supply stores for Binns & Co., Ltd., Fawcett Street; W. & T. R. Milburn, architects, 17, Fawcett Street. Technical college, Cowan's Terrace; C. T. Mark, architect, Education Office, John Street.

Surrey.—Buildings, Kingston-on-Thames, for School of Art (£30,500) and county technical college, West Barnes Lane, Raynes Park; county architect, Kingston-on-Thames.

Torquay.—School, Trumlands Road; St. Marychurch Priory R.C. managers.

Treforest.—Factory, for Worldwin Pistons, Ltd., Cyfartha, Merthyr.

Tynemouth.—Houses (36), Queen Street clearance area; W. H. Browse, builder, Church Way, North Shields.

Urmston.—Houses (73), Westbourne Park estate; Toft (Builders), Ltd., Railway Road.

Uxbridge.—Houses (54), Church Lane and Cowley Mill Road; U.D.C. surveyor.

Wakefield.—Houses, Flanshaw estate; borough architect.

Wallsend-on-Tyne.—Houses (122), Westmoreland estate, for the North-Eastern Housing Association; P. L. Browne, Son & Harding, architects, Pearl Buildings, Newcastle-on-Tyne. Cinema, for T. H. Pailor, West Hartlepool (£50,000); W. Pearson & Sons, builders, Stranton, West Hartlepool.

Walsall.—Houses (40), Goscote estate (£8,918); G. Insley, Ltd. Hotel, Wolverhampton Road, Bentley; Lavender & Twentyman, architects, Waterloo Road, Wolverhampton.

Warrington.—Houses (370), Long Lane estate; borough engineer. Houses (47), Venns Road estate; R. & S. Smith.

Wealdstone.—Cinema; Mr. Starkie, architect, Station Road, Harrow.

Wednesbury.—Houses (292); A. Booth, borough surveyor and architect, Town Hall.

Whitley Bay.—Cinema, North View; Dixon & Bell, architects, Pearl Buildings, Newcastle-on-Tyne.

Wigan.—Extensions to factory, for Brown & Haigh; H. Walls & Son, architects, Westwood estate office.

Windsor.—Cinema, Peascod Street, for Odeon Theatres, Ltd., Cornhill House, Bennetts Hill, Birmingham.

Wolverhampton.—Houses (30), Canterbury Road; W. Whittingham, Ltd. Houses (26), Hilston Avenue; A. & J. Mucklow. Factory, Tempest Street; G. H. T. Robinson, architect, 16, Queen Street.

Worthing.—Houses (19), Barnard Road; Novean Homes, Ltd.

Wrexham.—Houses (354), five parishes; R.D.C. surveyor.